

HARDWARE.....SOFTWARE.....AT HOME.....IN BUSINESS

computing today

JUNE 1982

ISSN 0142-7210

70p

FOR A PERSONAL
APPROACH TO MICROCOMPUTING

Micros on the Move

Putting the Osborne through its paces

Data and
program security...
are you taking
enough trouble?

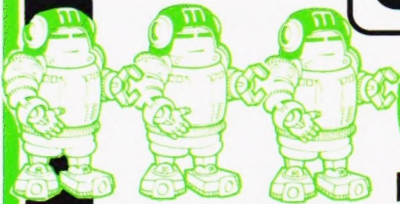
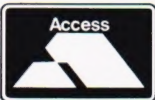
Make the move to
serious programming
with our two-pass
assembler



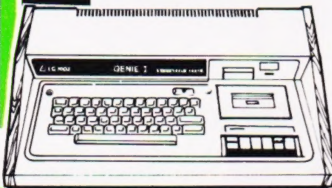
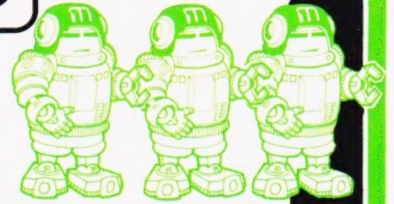
Simulating FORTH operations in BASIC

MicroStyle

29 BELVEDERE, LANSDOWN ROAD, BATH



(0225) 334659.

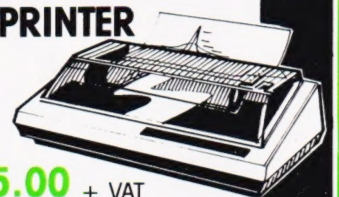


INGENIOUS Genie 1

All of the original GENIE SYSTEM plus: ★ Machine Language Monitor ★ Fitted Sound ★ Renumber Command ★ Full Lower Case ★ Screen Print ★ 16K ROM 13K RAM **£295** + VAT

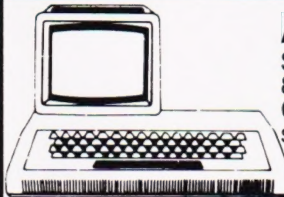
SEIKOSHA GP100A PRINTER

ENTIRELY NEW DESIGN. UNBELIEVABLY LOW PRICE. FULL GRAPHICS CAPABILITY. CENTRONICS PARALLEL INTERFACE. PAPER WIDTH ADJUSTABLE UP TO 10". **£195.00** + VAT



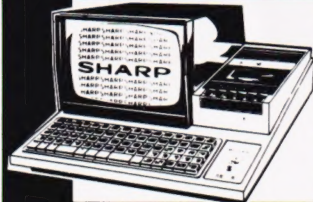
PRINTERS

EPSON MX80 EPSON MX100 ANADEX PAPER TIGER T.E.C. SCRIPTA MICROLINE 80.



ACORN ATOM

Sensational New Micro-Pack! 8K ROM 5K RAM, PSU included. Colour fitted. Starter pack software. **£170.00** + VAT



SHARP MZ80K

Full 48K Microcomputer with built-in cassette deck and monitor. THE ALL IN ONE COMPUTER – NO MESSY WIRES. Full range modular extensions available, printers, disk drives, etc. **£345** + VAT

GENIE II

The MacroComputer

Offering all the advantages of the Genie I system, with the benefit of advanced design for the professional user.

- ★ Terminal Routines
- ★ Facility to Upload & Download Price **£299**
- ★ Screen Print + VAT
- ★ 4 Defineable Function Keys + VAT
- ★ Full Upper & Lower Case

PROFESSIONAL EXTENSION KEYBOARD

for added efficiency of your ZX81. Plugs straight into existing ZX81 without desoldering. Simply unplug existing keyboard and plug in new one. **£25.00** + VAT

TANTEL PRESTEL ADAPTER

New ALPHA Numeric keyboard brings PRESTEL into your home. Converts black and white or colour TV. **£195.00** + VAT

VIDEO MONITORS

Complete range of VIDEO GENIE PERIPHERALS can now be linked to your TRS80 for only **£18.00** + VAT with the new 3023 BUS CONVERTOR

All sizes and prices
Black/white 9" **£90.00**
Black/white 12" **£65.00**
Green Screen 12" **£85.00**
Amber 9" **£95.00**
All Plus VAT

Plus!

Aculab Floppy Tapes

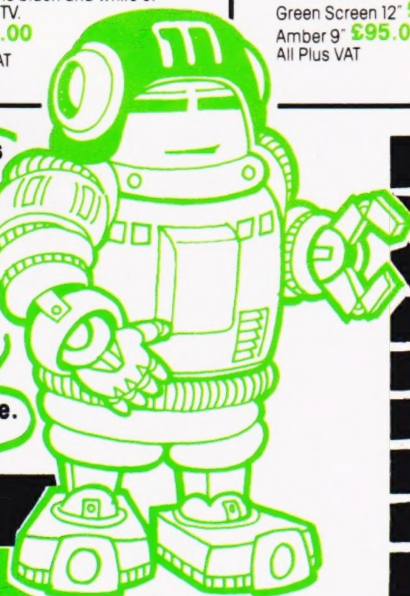
Special Offers – Ring and find out.

Vast Computer Book Selection.

Just a sample of what's in store for you!

ZX81 Software. TRS80 / Video

Genie Software. Diskettes.



Post to: MICROSTYLE, FREEDPOST, 29, Belvedere, Lansdown Road, Bath BA1 1FP

Please send me further details on the following, and your special offers;

C-T-1

Name _____

Company _____

Address _____

Tel: _____



Editor :
Henry Budgett
Advertisement Manager:
Mark Fisher
Advertisement Sales:
Beverley McNeill

CONTENTS

VOL 4 NO 4 JUNE 1982

EDITORIAL & ADVERTISEMENT OFFICE
145 Charing Cross Road, London WC2H 0EE.
Telephone 01-437 1002-7. Telex 8811896.



Editorial Assistants :
Tina Boylan, Roger Munford
Advertisement Copy Control :
Sandie Neville, Sonia Hunt
Managing Editor :
Ron Harris BSc
Managing Director :
T J Connell

Origination and design by
MM Design & Print.

ABC Member of the Audit Bureau of Circulation

Computing Today is normally published on the second Friday in the month preceding cover date. Distributed by: Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS. 01-247 8233. Printed by: Alabaster Passmore & Sons Ltd, Maidstone, Kent.

The contents of this publication including all articles, designs, plans, drawings and programs and all copyright and other intellectual property rights therein belong to Argus Specialist Publications Limited. All rights conferred by the Law of Copyright and other intellectual property rights and by virtue of international copyright conventions are specifically reserved to Argus Specialist Publications Limited and any reproduction requires the prior written consent of the Company. © 1982 Argus Specialist Publications Limited.

Subscription Rates : UK £11.50 including postage. Airmail and other rates upon application to Computing Today Subscriptions Department, 513 London Rd, Thornton Heath, Surrey CR4 6AR.

Computing Today is constantly on the look-out for well written articles and programs. If you think that your efforts meet our standards, please feel free to submit your work to us for consideration.

All material should be typed. Any programs submitted must be listed (cassette tapes and discs will not be accepted) and should be accompanied by sufficient documentation to enable their implementation. Please enclose an SAE if you want your manuscript returned, all submissions will be acknowledged. Any published work will be paid for.

All work for consideration should be sent to the Editor at our Charing Cross Road address.

CONSUMER NEWS8

Product proliferation for the personal computer user.

BUSINESS NEWS 12

Offerings for the business and professional micro owner.

SOFTWARES ...16

More programs and packages for you to peruse.

TWO-PASS ASSEMBLER20

Make the most of assembly language programming.

A VOTING LOADER27

Load your program at top speed with the help of this software ballot box.

REFLECTIONS ..33

This month our graphics series takes a trip to the border.

OSBORNE 1 REVIEWED39

A moveable micro supplied with a pile of programs might look like your best buy. We look inside Adam Osborne's move into the hardware market.

SPECIAL REPORT48

Making noises with your micro can be made simple with an effects board. We try out a commercial unit.

PROGRAM PROTECTION ...53

The subtle approach to software security.

NAS DRAW57

Create a picture library on tape with this clever utility program.

#FILE63

More musings on the world of micros and their assorted problems.

FORTH SIMULATOR67

The program might be written in BASIC but it lets you write programs in FORTH.

CONNECTIONS .72

Continuing our look at the secrets of interfacing theory.

PRINTOUT77

Open forum for your ideas, comments and criticisms.

FIRST BYTES83

This month we take a look at how you can string it all together.

PROGRAMMING LANGUAGES88

Originally a specialist graphics package, GINO has now grown to be a language in its own right.

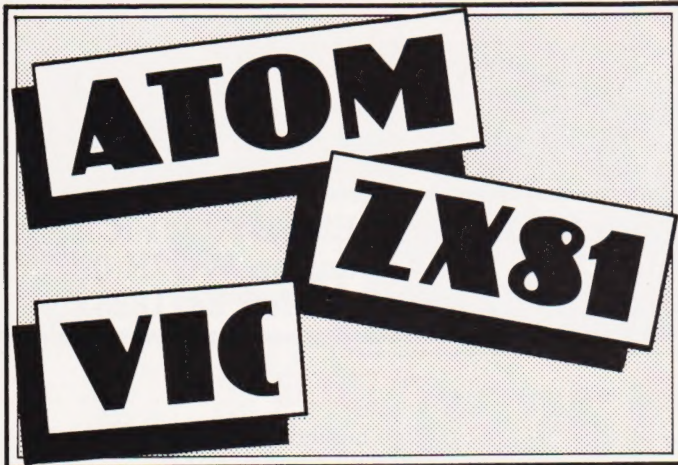
BOOK PAGE94

The BBC's Computer Literacy project has certainly sparked off a number of literary works.

CT STANDARDS .97

What they are, why they are used and how to interpret them.

Personal Software10
Our new quarterly magazine for programmers
Next Month's CT18
Forthcoming issues
ZX Computing45
The new publication for the Sinclair user
Subscriptions70
How to guarantee your monthly copy
CT Services80
Backnumbers, Photocopies and Binders available here
The Valley92
Get your copy of this best seller on tape
Computamart98
Locate your local store



**MAKE THE MOST OF YOUR MICROCOMPUTER
WITH OUR POPULAR RANGE OF PROVEN
BOOKS:—**

- GETTING ACQUAINTED WITH YOUR ZX81**, by Tim Hartnell. Eighty plus programs in this 120-page book, including draughts. **£5.95**
- 20 SIMPLE ELECTRONIC PROJECTS FOR THE ZX81 and other computers** by Stephen Adams **£6.45**
- SYMPHONY FOR A MELANCHOLY COMPUTER** by Tim Hartnell. 20 great Vic games **£6.95**
- 39 TESTED PROGRAMS FOR THE ACORN ATOM** Best of Interface **£6.45**
- MASTERING MACHINE CODE ON YOUR ZX81 OR ZX80**, by Toni Baker. 180 pages, teaches machine code from first principles. **£7.50**
- 49 EXPLOSIVE GAMES FOR THE ZX81**, edited by Tim Hartnell. **£5.95**
- PASCAL FOR HUMAN BEINGS** by Jeremy Ruston **£4.95**
- 34 AMAZING GAMES FOR THE 1K ZX81** by Alastair Gourlay **£4.95**
- THE GATEWAY GUIDE TO THE ZX81 AND ZX80**, by Mark Charlton. Over 60 programs and routines, ZX BASIC explained in detail. **£6.45**
- GETTING ACQUAINTED WITH YOUR ACORN ATOM**, by Trevor Sharples and Tim Hartnell. 184 pages, 80 programs, including draughts. **£7.95**
- GETTING ACQUAINTED WITH YOUR VIC 20**, by Tim Hartnell, with over 60 programs to get your VIC up and running from day one. **£6.95**
- INTERFACE**, the monthly magazine published by the National ZX80 and ZX81 Users' Club, in conjunction with the Independent Atom Users' Group, is just £9.50 (UK), £12.50 (Europe) for 12 issues. **Sample copy**, with many programs for each machine, book, software and hardware reviews, education, contact addresses, **just £1**.

Please send me the items marked. I enclose £

Name:

Address:

.....

.....

Postcode

Please make cheques payable to **INTERFACE** and send the above form, or a copy, to: **INTERFACE**, Dept. CT, 44-46 Earls Court Road, London W8 6EJ

TEXAS INSTRUMENTS HOME COMPUTER STOCKISTS

ABERDEEN Dixons **ALTRINCHAM** Boots **ASHFORD** Rumbelows **BARNET** Rumbelows **BASILDON** Rumbelows **BASINGSTOKE** Boots **BATH** Boots, Microstyle **BEDFORD** Carlow Radio, Rumbelows, Boots, Comserve **BILLERICAY** Rumbelows **BIRKENHEAD** Dixons **BIRMINGHAM** Dixons, Comet, Hewards Home Stores, Boots **BLACKPOOL** Boots **BLETCHLEY** Rumbelows **BOREHAMWOOD** Rumbelows **BRADFORD** Ackroyd Typewriters **BRAINTREE** Rumbelows **BRENTWOOD** Rumbelows **BRIGHTON** Gamer, Boots **BRISTOL** Dixons **BROMLEY** Rumbelows, Boots **BROMYARD** Acoutape Sound **CAMBRIDGE** Rumbelows, Dixons, Heffers **CANTERBURY** Rumbelows, Dixons **CARDIFF** Boots, Dixons, Computer Business Systems **CARLISLE** Dixons **CHELMSFORD** Dixons, Rumbelows **CHESTER** Boots **CHINGFORD** Rumbelows **COLCHESTER** Rumbelows **CORBY** Computer Supermarket **CREWE** Midshires **CROYDON** Boots, Dixons, Allders **DARTFORD** Rumbelows **DERBY** Datron Microcentre, Boots **DORRIDGE** Taylor Wilson **DUNSTABLE** Rumbelows **EASTBOURNE** Rumbelows **EDINBURGH** Robox, Esco, Texas Instruments, Dixons, B.E.M. **ENFIELD** Rumbelows **EXETER** Peter Scott, Boots, Dixons **GLASGOW** Boots, Esco, Robox, Dixons **GT. YARMOUTH** Rumbelows **HANLEY** Boots **HARLOW** Rumbelows **HATFIELD** Rumbelows **HEMEL HEMPSTEAD** Rumbelows, Dixons **HITCHIN** Rumbelows **HODDESDON** Rumbelows **HULL** Radius Computers, Boots, Dixons, Peter Tutty **ILFORD** Boots **IPSWICH** Rumbelows **KINGSTON** Dixons **LEEDS** Dixons, Boots, Comet **LEICESTER** Dixons, Boots **LEIGHTON BUZZARD** Computopia **LETCHWORTH** Rumbelows **LINCOLN** Dixons **LIVERPOOL** Dixons, B.E.C. Computerworld **LONDON: Balham** Argos **Bow** Rumbelows **Brent Cross** Dixons, Boots **Camden Town** Rumbelows **City Road** Sumlock Bondain **Clerkenwell** Star Business Machines **Curtain Road** Eurocalc **Ealing** Adda Computers **EC1** Argos **Edmonton** Rumbelows **Finchley Road** Star Business Machines **Fulham** Mondial **Goodge Street** Star Business Machines **Hackney** Rumbelows **Hammersmith** Dixons **Hendon** Futurtronic **Holborn** Dixons **Hounslow** Boots **Kensington High Street** Video Palace **Knightsbridge** Video Palace, Harrods **Loughton** Rumbelows **Marble Arch** Star Business Machines **Moorfield** Dixons **Moorgate** Star Business Machines **New Bond Street** Dixons **NW1** Mountandene **Oxford Street** Selfridges, H.M.V., Dixons **Regent Street** Star Business Machines **Tottenham Court Road** Landau, Eurocalc **Victoria Street** Army & Navy **Wandsworth** R.E.W. **Wood Green** Boots, Rumbelows **Woolwich** Rumbelows **LUTON** Dixons, Rumbelows **MAIDSTONE** Dixons, Boots, Rumbelows **MALDON** Rumbelows **MANCHESTER** Orbit, Boots, Dixons **MIDDLESBROUGH** Boots, Dixons **MILTON KEYNES** Rumbelows, Dixons **NEWBURY** Dixons **NEWCASTLE** Boots, Dixons **NORTHAMPTON** Dixons **NORWICH** Dixons, Rumbelows **NOTTINGHAM** Bestmoor, Dixons, Boots **ORPINGTON** Rumbelows **OXFORD** Science Studio **PETERBOROUGH** Boots **PLYMOUTH** J.A.D., Dixons **PORTSMOUTH** Boots, Dixons **POTTERS BAR** Rumbelows **PRESTON** Dixons **RAMSGATE** Dixons **RAYLEIGH** Rumbelows **READING** Dixons **RENFREW** Comet **ROMFORD** Rumbelows, Dixons **RUSHDEN** Computer Contact **SANDY** Electron Systems **SCARBOROUGH** Video +, **SHEFFIELD** Datron Microcentre, Dixons, Video +, Wigfalls **SITTINGBOURNE** Rumbelows **SLOUGH** Boots, Texas Instruments **SOUTHAMPTON** Dixons, The Maths Box **SOUTHEND** Rumbelows, Dixons **ST. ALBANS** Rumbelows **STEVENAGE** Dixons, Rumbelows **STRATFORD** Rumbelows **SUDBURY** Rumbelows **SWANSEA** Dixons **TONBRIDGE** Rumbelows **WALTHAM CROSS** Rumbelows **WALTHAMSTOW** Rumbelows **WARE** Rumbelows **WARRINGTON** Boots **WATFORD** Computer Plus, Computer Centre, **WELWYN GARDEN CITY** Rumbelows **WETHERBY** Bits & Pieces **WOLVERHAMPTON** Dixons **WOODFORD** Rumbelows

You can't get a Home Computer from Texas Instruments under 16 K RAM.



Make the right move into computing with the Home Computer from Texas Instruments. It gives you a large combined RAM/ROM capacity up to 110 K Byte and the ability to expand with a full range of peripherals and software. So as your knowledge of computers increases the TI Home Computer will grow with you.

Just compare the versatility of the TI Home Computer with its price—you'll find it real value for money that will prove to be a good long term investment.

The TI-99/4A is a sophisticated computer designed not only for the beginner with its ease of operation, but also for the professional with its vast computing power through a 16 bit microprocessor. And it simply plugs into an ordinary household TV set.



With its high resolution graphics with 32 characters over 24 lines in 16 colours (256 x 192 dots), 3 tones in five octaves plus noise, and BASIC as standard equipment and options such as other programming languages—UCSD-PASCAL, TI-LOGO and ASSEMBLER—and speech synthesis, you'll find that the TI 99/4A more than compares with the competition. Especially when the starting price is £340 or less. When you want to solve problems there are over 600 software programs available worldwide—including more than 40 on easy-to-use Solid State Software® Modules.

After all, from the inventors of the microprocessor, integrated circuit and microcomputer, it's only natural to expect high technology at a realistic price.



Enjoy a new world of learning.

TEXAS INSTRUMENTS
LIMITED

Registered Trade Mark
Texas Instruments



ZX80/1

**£37.95
incV.A.T.**

ZX KEYBOARD FULLY CASED WITH REPEAT KEY



- Fully cased keyboard £37.95
- Uncased keyboard £27.95
- Keyboard Case £10.95

This is a highly professional keyboard using executive buttons as found on top quality computers. It has a repeat key and comes complete in its own luxury case. This is a genuine professional keyboard and should not be confused with toy keyboards currently available on the market.

16K RAMPACK MASSIVE ADD ON MEMORY FULLY CASED

**£32.95
incV.A.T.**

comes fully assembled, tested and guaranteed

The 16K Rampack plugs straight into the user port at the rear of your computer. And of course as in all our products the Rampack is fully enclosed in a matt black slimline plastic case.

This means you can handle it with complete safety and you do not have to stare at ugly components — as in other makes of 16K. The Rampack NEEDS NO EXTRA POWER and will operate quite happily on your sinclair power supply.

Don't forget you can always order on the telephone with your credit card.

6 Days a week for a same day service

**WHY WAIT TO PAY MORE?
FAST IMMEDIATE DELIVERY**

Post To
Dept CT1
**KAYDE ELECTRONIC
SYSTEMS**
48/49 Exmouth Road
Great Yarmouth
Norfolk NR30 3DP
Tel 0493 57867

| | |
|---|-------------|
| PLEASE SEND ME..... RAM PACK/S | £32.95 each |
| PLEASE SEND ME..... CASED KEYBOARD/S | £37.95 each |
| PLEASE SEND ME..... UNCASD KEYBOARD/S | £27.95 each |
| PLEASE SEND ME..... KEYBOARD CASE/S | £10.95 each |
| I enclose £..... | |
| NAME | |
| ADDRESS | |
| | |
| | |
| Please add £1.50 P&P and make cheques payable to Kayde Electronic Systems. | |

MICROCOMPUTER PRODUCTS

MPI

INTERNATIONAL LTD.

ROOM CT. 8-9 CAMBRIDGE HOUSE, CAMBRIDGE ROAD, BARKING, ESSEX IG11 8NT, ENGLAND

Telephone: 01-591 6511 Telex: 892395

GENERAL

Hardware orientated:

| | |
|--|--------|
| Some Real Microprocessors | £20.85 |
| 6 Updating Supplements for Some Real Microprocessors | £20.85 |
| Some Real Support Devices | £13.00 |
| 6 Updating Supplements for Some Real Support Devices | £20.85 |
| Microprocessors from Chips to Systems | £11.45 |
| Microprocessor Interfacing Techniques | £13.10 |
| * IC OP-AMP Cookbook | £9.85 |
| * RTL Cookbook | £4.25 |
| * IC Timer Cookbook | £7.50 |
| 8089 I/O Processor Handbook | £4.95 |
| The CRT Controller Handbook | £5.95 |
| The 68000 Microprocessor Handbook | £5.95 |
| 16 Bit Microprocessor Handbook | £15.95 |
| 4 and 8 Bit Microprocessor Handbook | £15.95 |

Software Listings:

| | |
|--|--------|
| * Some Common BASIC Programs | £9.85 |
| * Practical BASIC Programs | £10.25 |
| * Professional Programs: Chess, Medbil, Wdproc | £25.00 |

Business:

| | |
|--|--------|
| * Accounts Payable and Accounts Receivable | £14.85 |
| * General Ledger | £14.85 |

Other:

| | |
|--|--------|
| PIMS: Personal Information Management System | £6.50 |
| * Buyers Guide to Microsoftware | £2.40 |
| Program Design | £4.75 |
| Programming Techniques: Simulation | £4.75 |
| Numbers in Theory and Practice | £6.00 |
| K2 FDOS | £15.50 |
| CP/M Handbook | £12.10 |
| CP/M Users Guide | £10.10 |
| * Calculating with BASIC | £4.95 |
| * Dr Dobbs Journal Vol 1 | £15.50 |
| * Dr Dobbs Journal Vol 2 | £15.50 |
| * Dr Dobbs Journal Vol 3 | £15.50 |
| * Best of Interface Age: Software | £9.95 |
| Programming the Z8000 | £12.10 |
| Z8000 Assembly Language Programming | £14.85 |

FOR THE Z80, TRS-80, ZX81, 380Z

| | |
|---|--------|
| Z80 Assembly Language Programming | £13.50 |
| Z80 Instruction Handbook (Wadsworth) | £5.00 |
| Programming the Z80 (Zacs) | £11.95 |
| 32 BASIC Programs for the TRS-80 (Level II) 16K | £11.10 |
| Introduction to the T-Bug | |
| (Guide to TRS-80 Machine Language Monitor) | £7.60 |
| * 30 Programs for the Sinclair ZX80 | £6.95 |
| Cambridge Collection for the ZX81 | £4.95 |

CONCERNING LANGUAGE

| | |
|---|--------|
| Beginners Guide to the UCSD PASCAL Systems | £9.50 |
| A Practical Introduction to PASCAL | £4.95 |
| The PASCAL Handbook | £13.95 |
| Introduction of PASCAL (including UCSD PASCAL) | £11.50 |
| SCELBAL—BASIC Language Interpreter (Source Code) | £10.00 |
| BASIC BASIC | £8.15 |
| Advanced BASIC | £6.50 |
| * Users Guide to North Star BASIC | £10.00 |
| Microsoft BASIC (a guide) | £8.95 |
| * Secret Guide to Computers (to teach yourself BASIC) | £4.00 |
| Fifty BASIC Exercises | £10.25 |
| PASCAL Programs for Scientists & Engineers | £12.70 |
| A Microprogrammed APL Implementation | £18.00 |
| A Guide to Forth IV Programming | £8.00 |

FOR THE 6502

(PET, APPLE, ATARI etc.)

| | |
|---|--------|
| Best of Micro, Vol 2 | £5.50 |
| Programming the 6502 (Zacs) | £10.75 |
| 6502 Applications | £10.25 |
| 6502 Instruction Handbook | £3.50 |
| Library of PET Subroutines | £10.00 |
| * 32 BASIC Programs for the PET | £11.10 |
| First Book of KIM | £7.00 |
| PET CBM Personal Computer Guide (2nd edition) | £11.00 |
| Apple II Users Guide | £11.50 |
| PET and the IEEE (GPIB) Bus | £10.95 |
| 6502 Assembly Language Programming | £11.85 |
| * Some Common BASIC Programs (PET CBM, Edition) | £9.85 |

NEW BOOKS

| | |
|---|--------|
| Don't (or How To Care for Your Computer) | £9.55 |
| Science and Engineering Programs for the Apple II | £11.60 |
| Some Common BASIC Programs for the ATARI | £11.10 |
| Computes First Book of ATARI | £10.25 |
| Interfacing to S-100/IEEE 696 Microcomputer | £11.10 |
| Introduction to Word Processing | £11.45 |
| WORDSTAR Made Easy | £5.95 |
| Users Guide to UNIX | £11.60 |
| Programming BASIC TI Home Computer | £11.25 |

FANTASTIC DISCOUNTS!

We are re-vamping our current list of books and are pleased to be able to offer you a 25% DISCOUNT On all titles marked with a star *. All orders must be accompanied by cheque, cash or postal orders. Normal p & p (see order info. below). Payment will be returned if the book you want is no longer in stock.

FOR THE 8080

| | |
|--|--------|
| * 8080 Programming for Logic Design | £6.30 |
| * 8080 Hex Code Card | £2.30 |
| * 8080 Octal Code Card | £2.30 |
| * 8080 Software Gourmet Guide and Cookbook | £7.15 |
| * 8080 Standard Monitor | £8.95 |
| * 8080 Standard Assembler | £8.95 |
| * 8080 Standard Editor | £8.95 |
| 8080 Special Package: Monitor, Editor, Assembler | £20.00 |
| BASEX: A Simple Language and Compiler for the 8080 | £6.00 |

FOR THE 6800

| | |
|---|--------|
| * 6800 Software Gourmet Guide and Cookbook | £7.85 |
| * 6800 Tracer—An aid to 6800 Program Debugging | £4.50 |
| * Tiny Assembler | £6.30 |
| RA 6800 ML—An M6800 Relocatable Macro Assembler | £17.50 |
| Link 68—An M6800 Linking Loader | £6.00 |
| MODEB—An Advanced M6800 Monitor Debugger | £3.85 |

FOR FUN

| | |
|---|--------|
| * 8080 Galaxy Game | £6.95 |
| * SUPER-WUMPUS—A Game in 6800 Assembler Code & BASIC | £4.25 |
| * Computer Rage (a Board Game) | £6.95 |
| Introduction to TRS-80 Graphics | £6.30 |
| * Take My Computer Please... (Fiction) | £3.25 |
| * Introduction to Low Resolution Graphics for PET, Apple TRS-80 | £6.00 |
| 6502 Games | £10.25 |
| Inside BASIC Games | £11.50 |

MAGAZINE BACK ISSUES

| | |
|---------------------------------|--------|
| Micro 6502 Journal | £3.00 |
| Personal Computing | £3.00 |
| Interface Age | £3.25 |
| Dr Dobbs Journal | £2.15 |
| Computer Music Journal | £3.75 |
| Recreational Computing | £2.15 |
| BYTE | £3.60 |
| Creative Computing | £4.25 |
| Calculators and Computers | £1.95 |
| Kilobaud Microcomputing | £4.25 |
| Compute—for the 6502 | £3.75 |
| 68' Micro | £2.50 |
| 80-Microcomputing | £4.95 |
| On Computing | £1.95 |
| S-100 Microsystems | £2.50 |
| 99 ER | £4.00 |
| 99'ER Subscription (6 issues) | £18.00 |
| Magazine Storage Box (holds 12) | £2.15 |

BYTE NIBBLE REPRINTS:

| | |
|--|--------|
| a) A TMS-9900 Monitor | £3.50 |
| b) BASIC Cross-Reference Generator | £1.25 |
| c) 'Tiny' PASCAL in 8080 Assembly Language | |
| (if needed to use this) | £13.00 |
| d) A 'Tiny' PASCAL Compiler | £13.50 |
| e) An APL Interpreter in PASCAL | £13.00 |
| f) Computer Assisted Flight Planning | £2.35 |
| g) Computerised Wine Cellar | £2.00 |
| h) The Design of an M6800 Lisp Interpreter | £13.00 |

FOR THE NOVICE

| | |
|--|--------|
| * Getting Down to Business with Your Microcomputer | £5.50 |
| * Getting Involved with Your Own Computer | £5.50 |
| * How to Profit from Your Personal Computer | £6.50 |
| * Microcomputer Potpourri | £1.95 |
| * Hobby Computers are Here | £3.00 |
| * New Hobby Computers | £3.00 |
| * Understanding Microcomputers and Small Computer Systems | £7.50 |
| * Understanding Microcomputers and Small Computer Systems and Audio Cassette | £9.25 |
| * From the Counter to the Bottom Line | £10.00 |
| * Buying a Business Computer | £9.75 |
| * How to Make Money with Your Microcomputer | £7.00 |

ORDER INFORMATION

MAGAZINES: Magazine back issues that are not currently in stock are often difficult to obtain. For unavailable and out of print back issues there is a photocopying service at 15p per page plus 30p p. p. plus VAT.

BOOKS: Most books are published in the USA and stocked in Britain by Microcomputer Products International Ltd. We aim to keep all of these books in stock and as a result of this, most prepaid orders are despatched by return of post.

Please add £1.00 towards postage plus 15p VAT for EACH book purchased. If purchasing more than 3 books at any one time, please add 25p plus 4p VAT for each extra title (over the 3).

PAYMENT: All payment must be in sterling and drawn against a UK Bank. Send cash, cheques, postal orders, IMD, Access or Barclaycard No. to: Microcomputer Products International Ltd., Room CT. 8-9 Cambridge Road, Barking, Essex IG11 8NT, Telephone: 01-591 6511, Telex: 892395.

Retailer and OEM terms

MAIL ORDER TELEPHONE CREDIT CARD ORDER

* VISIT *

Full descriptive CPM Software Catalogue: available £1 — deductible from first purchase

Trade Enquiries Welcome



COMMODORE'S ▲ PROLIFERATION

At the Hanover Fair yesterday, April 23rd, Commodore unveiled its long-awaited new product range to the UK Press and dealers.

The VIC 10 is not really a micro, being based around the new generation of video and music devices but it does have the facility for fitting a mini version of VIC BASIC contained in a cartridge with 2K of user RAM.

The Commodore 64 is an interesting beast. Fitted into a VIC-style case, it is based on the new 6510 processor and includes 64K of addressable RAM. When using the built-in BASIC, some 38K of RAM is available for BASIC programs but the BASIC ROMs can be switched out allowing a new language to be loaded into the whole 64K memory area.

The 500 series will be based around the 6509 CPUs and feature expansion to 256K RAM. The range is intended to be fully compatible with the existing range, it has the IEEE port and the kernel of its BASIC is compatible with existing systems. Unfortunately it doesn't have an integral display, relying instead on a conventional TV.

The new super-system is the 700 series and this is a very interesting product indeed. Complete with twin integral discs, detached keyboard and built-in tiltable screen, it not only looks nice but handles well too. Once again it's based on the 6509 processor with 256K of RAM and 340K of disc storage.

Prices for the new systems start at £100 for the VIC 10 (available September), £400 for the Commodore 64 (available October), £695 for the 500 (available September) and £1595 for the 720 with a slimmed-down version called the 710 available at £995 (both released in September). Henry Budgett

AT THE END OF THE RAINBOW ▼

Well, the rumours were true after all. Today, Clive Sinclair unveiled his new personal computer called, not the ZX82, but the ZX Spectrum.

Based on the Z80A microprocessor, the ZX Spectrum comes in two versions complete with either an internal 16K RAM priced at £125 or with 48K at £175 (both prices are inclusive of VAT). An optional upgrade from 16K to 48K will be offered by Sinclair Research in the near future for around £60.

With a name like the ZX Spectrum, it will come as no surprise that the new machine is capable of high-resolution colour graphics accessed by PLOT, DRAW and CIRCLE. Using an enhanced version of Sinclair's ZX81 BASIC programming language, it is also capable of sound generation and supports up to 52 user-definable functions via a full typewriter-compatible 40 moving-key ASCII keyboard.

An expansion port permits the ZX Spectrum to be linked with the existing Sinclair ZX Printer; other printers will, at a later stage, be able to be used via an RS232 port. A network interface allows the new machine to be linked to other ZX Spectrums and there is further port intended to support up to eight ZX Microdrives. The ZX Microdrive is a microflop data storage unit containing 100K for around £50; these units will be released later in the year.

The ZX Spectrum will be available immediately but by mail order only. ZX Spectrums can be ordered by 'phone using Access or Barclaycard 24 hours a day on 01-200 0200 or from Sinclair Research at FREEPOST, Camberley, Surrey GU15 3BR. Clive promises a turnaround time for orders of about two weeks — we wish him luck!



SPRING LAUNCH FEVER

ACORN SECRETS LEAK

If you were looking for a full-feature personal computer and were offered a 6502-based system with BBC BASIC, 32K of user RAM, eight colour graphics on an 8K screen (320 x 200 pixels), dual speed cassette and programmable sound generator you might begin to reach for your wallet. Well, the indications are very strong indeed that come August time Acorn will be launching a mini-version of the BBC micro called The Electron. Chris Curry of Acorn Computers would neither confirm or deny the news but sources close to the company indicate that the plans are very well advanced.

The machine will be sold by Acorn, not the BBC, and is intended to compete directly with the Sinclair's ZX Spectrum. Its expansion capability includes Econet and printer interfaces so it could be used in the classroom as an ATOM replacement. Other built-in goodies include 10 programmable function keys, both PAL and NTSC colour output, indicating that Acorn may be about to attack the US market, and a selectable screen format of 20 by 25 or 40 by 25 offering a direct challenge to the VIC 20 and the slimmed-down Commodore 64 system called the VIC 30.

The price is believed to be between £120 and £150 and the machine will enter volume production during the last quarter of this year. As we get more information we'll let you know! Henry Budgett

CONSUMER NEWS



APPLE CART ▲

And yet another for the Apple II... this interface is called PORTAPPLE. It comprises a portable data collection terminal which can store up to 32K of data which can be input through the keyboard and/or a bar-code scanner.

Numerous applications in the field are possible — for example, stock recording, incomplete records, market and industrial research, data processing and order recording.

The retail price of the PORTAPPLE system comprising an 8K data collector, bar-code scanner, bar-code starter pack, interface card and system software is £975. For further information get in touch with Mektronic Consultants, Linden House, 116 Rectory Lane, Prestwich, Manchester M25 5DB or 'phone them on 061-798 0803.

CALLING ALL TEACHERS

Transam Computers and Hutchinson Education have announced a microcomputer software competition aimed at primary and secondary school teachers. Prizes totalling £1,750 will be awarded to the first 12 winners with guaranteed publication of the winning programs.

Entry forms giving full details of the competition are available from 'Prime Programs', 17 Conway Street, London W1P 6JD; you could always 'phone Bob Osborne on 01-387 2811 if you're in a hurry!

Prime Programs are also hoping to publish a book of listings of the 40 best programs submitted other than the prize winners.

STAY SHARP

Receiving a sharp picture? Perhaps you need the multi-screen microcomputer display system introduced for the Sharp range of personal micros.

For the Sharp MZ-80K and MZ-80B, two monochrome models are available: Triple-Vision providing output to a standard UHF or projection TV plus up to 12 monitors with sound and Multi-Vision providing sound and vision on up to 12 monitors fitted with audio playback facilities.

Multi-Vision and Triple-Vision are available from Sharp dealers at £35 and £79 respectively, fitting extra. For further information contact Ian Dunkley, the Managing Director of the Datron Micro Centre, 2 Abbeydale Road, Sheffield S7 1FD or 'phone him on 0742-585400.

HEAT TREATMENT ▼

Two 40 character per line printer/plotter models have been added to the Roxburgh range of thermal printer mechanisms.

The PU1840-2P has 20 thermal

elements and a print speed of two lines per second. The PU1840-4P has 40 thermal elements and consequently, a print speed of four lines per second. Both models have automatic paper advance at the end of each line and can print graphics as the 280 dots per line are all individually addressable.

The PU1840-2P is priced at £61.50 and the PU1840-4P comes at £67.70; considerable savings can be achieved if you decide to buy 100 off (!). Further details can be made available by 'phoning 07973-3777 and asking for Mike Davis or you could write to him at Roxburgh Printers Ltd, 22 Winchelsea Road, Rye, E Sussex TN31 7BR.

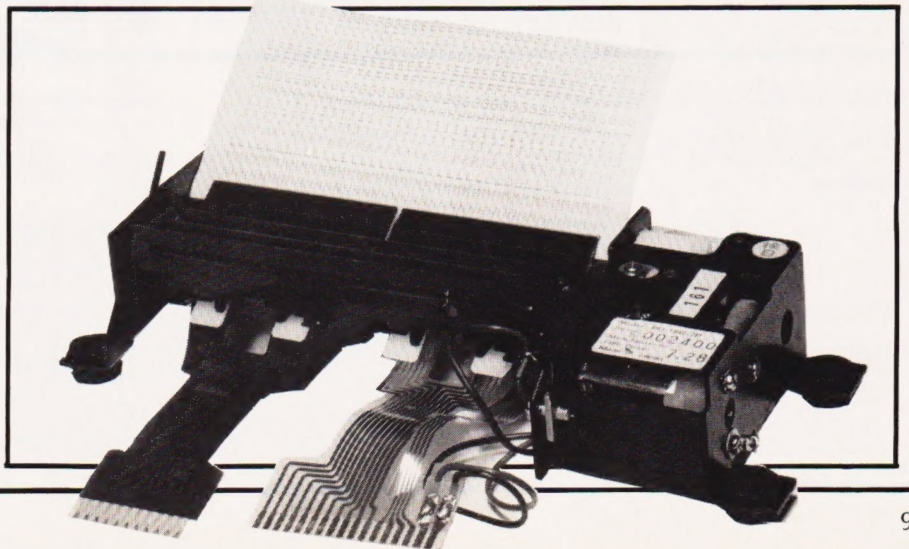
A BIT ON THE SIDE

Have you ever wanted to turn your VIC-20 into a multi-purpose business machine? Well, now you can with an add-on from Beelines Ltd, an associate company of B & B Computers of Bolton.

The 'magic' black box increases the VIC's 22 column display to 40 and expands its memory from 3K to 35K. Apart from a sophisticated colour writer and a 32K RAM board, the box also boasts an additional power supply unit to deal with the extra electronics.

Complete with all connecting cables and a 12 month guarantee, the new interface will sell for £220 plus VAT. It will be available from selected dealers and direct by mail order from Beelines, Freepost, Bolton BL3 6YZ.

For further information on the VIC box and also the new VIC-6 cassette (Volume One contains six programs for £9.95) get in touch with John Blackburn on 0204-382471.



Personal SOFTWARE

Personal Software is a new quarterly publication from the people who bring you Computing Today. To celebrate the launch of the BBC Microcomputer our first issue will consist of more than 20 programs covering Domestic, Financial, Educational, Games and Scientific areas.

All the programs are fully tested and documented and the listings have been produced directly from the BBC Micro to eliminate errors. As an additional service we are offering copies of the programs on tape through our CT Software organisation.

As well as featuring the best software from previous issues of Computing Today converted for the BBC Micro in order to show off its advanced features, the publication also includes a number of specially commissioned programs which reveal *even more* special functions.

If you own or have ordered a BBC Micro, or are just looking for a collection of Extended BASIC programs to convert to your system, then you need Personal Software: BBC Programs.

Personal Software will be on sale at your local newsagent from Friday 14th May at £1.95 or you can order directly from us at £7.80 per annum or £1.95 per copy. To ensure a single copy or a complete year's supply fill in the form below — you can even spread the load with your credit card.

SUBSCRIPTION ORDER FORM

Cut out and SEND TO :

Personal
SOFTWARE

513 LONDON ROAD,
THORNTON HEATH,
SURREY,
CR4 6AR.

POST FREE
SUBSCRIPTION

Please use BLOCK CAPITALS and include post codes.

Name (Mr/Mrs/Miss)

delete accordingly

Address

Signature

Date

Please commence my subscription to Personal Software with the issue.

SUBSCRIPTION RATES (tick as appropriate)

£7.80 for 4 issues
UK

£1.95 for a single
copy of the issue

I am enclosing my (delete as necessary)
Cheque/Postal Order/International Money
Order for £.....
(made payable to ASP Ltd)



OR
Debit my Access/Barclaycard*
(*delete as necessary)



Insert card no.

Castle Electronics

Service - at Supermarket Prices!

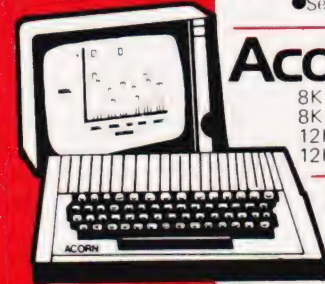
ALL PERSONAL
COMPUTER ENQUIRIES
HASTINGS
(0424)
437875



VIC-20 COLOUR COMPUTER

- Graphics character set ● Plug-in programme/memory cartridges
- Colour ● Sound ● Programmable function keys ● 5K memory expandable to 32K ● Standard PETBASIC ● Full-size typewriter keyboard ● Low-priced peripherals ● Joystick/paddles/lightpen ● Self teaching materials ● Cassette Deck now available £44.95

Only
£189-95
INC. VAT



Acorn Atom BRITISH DESIGNED PERSONAL COMPUTER

| | | | |
|-----------------------------|---------|-----------------------------|---------|
| 8K ROM + 2K RAM kit | £140.00 | 4K Floating Point ROM | £ 23.00 |
| 8K ROM + 2K RAM Ass. | £174.50 | Colour Encoder | £ 21.85 |
| 12K ROM + 12K RAM kit | £255.00 | Mains Power Supply | £ 9.20 |
| 12K ROM + 12K RAM Ass. | £289.50 | | |

YOU
WON'T FIND
A BETTER DEAL
ANYWHERE IN
THE SOUTH

TANGERINE microtan

| | |
|------------------------------|--------|
| Microtan 65 Kit | £79.35 |
| Microtan 65 Built | £90.85 |
| Tanex Min. Config. Kit | £49.45 |
| 20 way Keypad | £11.50 |

TANTEL PRESTEL ADAPTER - £199.00

We hold a complete stock of all the Tangerine equipment. Send SAE or Phone for details.



COMPUTERS FOR PEOPLE



FROM £345.00
Plus All Accessories Available!

| | |
|-----------------------|---------|
| Model 400 16K | £345.00 |
| Model 800 16K | £645.00 |
| Cassette | £ 50.00 |
| Disk Drive | £345.00 |
| 80 Col. Printer | £550.00 |

COMMODORE PET

| | |
|-------------------------|---------|
| 16K PET | £550.00 |
| 32K PET | £699.00 |
| Dual Disk Drive | £699.00 |
| Printer | £454.25 |
| External Cassette | £ 44.95 |

Complete range of PET equipment in Stock

CASSETTE SOFTWARE: Strathclyde Basic Course, Basic Basic Course, Invaders, Treasure Trove of Games 1 to 10 (10 Selections of games), Basic Maths, Algebra, Statistical Packs and lots more!



Special Offer!
sinclair ZX81 FOR IMMEDIATE DESPATCH
£69.99



BUILT-IN SOUND-HIGH RES. GRAPHICS

| | |
|-------------------------------|---------|
| Apple II Plus 48K | £790.00 |
| Disk Drive + Controller | £383.00 |
| D.D. without Cntrller | £303.00 |
| Pascal Card | £264.00 |
| Eurocolour Card | £73.00 |
| Hitachi 9" Monitor | £146.00 |

We Stock All the Goodies for Apple!



ALL PRICES INCLUDE VAT : ACCESS & BARCLAYCARD WELCOME
ORDERS NORMALLY DESPATCHED DAY OF RECEIPT

WE SPECIALISE IN COST EFFECTIVE SYSTEMS FOR SMALLER BUSINESSES

South East Computers MicroComputers for Business

ASK FOR DETAILS OF OUR TOTAL SUPPORT OPTION

From Only £19 per week

Package A

SILICON OFFICE SYSTEM

- 1 x CBM 8096 Computer
- 1 x CBM 8050 Dual Disk Drive
- 1 x CBM 8023 Matrix Printer
- Connecting cables, plus Silicon Software

From Only £43 per week

Package B

ALTOS MULTI-USER HARD DISK SYSTEM

- 1 x ALTOS 8000/10 Computer with 10 Mbyte Hard Disk
- 208Kbyte Memory (4 users)
- 500Kbyte Floppy Disk Drive
- 2 x TVI 912C VDU's
- 1 x OKI Microline 83A Printer

UNBEATABLE OFFERS FOR EDUCATION & TRAINING CONTACT US NOW!

SEC BUSINESS SYSTEMS SUPPLY A WIDE RANGE OF EASY-TO-OPERATE SYSTEMS AND PROGRAMMES TO MEET ALL OF TODAY'S BUSINESS NEEDS + FULL RANGE OF COMPUTER RELATED PRODUCTS + LEASING AGREEMENTS + FULL AFTER SALES SERVICE



The Complete Computer Service!

FOR ALL BUSINESS SYSTEMS ENQUIRIES:-
Phone Nick Rosenberg on Hastings (0424) 426844

15 CASTLE STREET, HASTINGS, EAST SUSSEX TN34 3DY Dept. CT6



THREE UP ▲

Unlike the Genie I and II, the Genie III is a fully expanded and integrated microcomputer containing 64K of RAM, a built-in screen, a dual disc drive with double-density storage facility and a keyboard with the full ASCII keyset and numeric keypad.

Based on the Z80A CPU, the Genie III includes a parallel port, a serial port and a cassette interface. The system incorporates 5¼" double track double-density disc drives; four drives can be daisy-chained together to provide storage capacity of up to 1.4M. Also, if you're prepared to wait a little, there's talk of double-sided double track drives being available which would effectively double the storage capacity.

No problem with software either, the Genie III is fully programmable in both CP/M and Level II BASIC.

The basic Genie III computers will retail for around £1,600. For further information get in touch with Lowe Electronics, Bentley Bridge, Chesterfield Road, Matlock, Derbyshire or telephone them on 0629-2430.

SWEETLIPS!?!

No, it's not a new character in 'M*A*S*H'... it's an intelligent small-format pen plotter featuring two-colour capability, high resolution plotting and a printing speed of 15 inches per second.

Designated the HP7470, the SWEETLIPS plotter is compatible with a wide variety of both large and small Hewlett-Packard computers, including the HP-87, as well as personal and business

computers from IBM, Apple and Commodore.

In all, the HP7470 has an eight-bit MC6802 microprocessor, two CMOS logic gate arrays, an interface LSI chip, an 8K ROM and a 256K RAM.

The price of the SWEETLIPS plotter (with either interface HP-IB (HP's IEEE-488) or RS-232C) is £969 + VAT. For further details contact Hewlett-Packard Ltd, Nine Mile Ride, Easthampstead, Wokingham, Berks RG11 3LL. Telephone enquiries can be made on 03446-3100.

DESKTOP TRIO

Sanyo have introduced three new computers, the MBC 2000, the MBC 3000 and the FDS 1000, especially for the wide range of applications required by small businesses.

The MBC computers desktop design incorporates boards (based on two 8085A microprocessors with 64K of RAM and 4K of ROM), a 12" VDU, a power source and two

built-in floppy disc drives. The disc drives in the MBC 2000 and 3000 have storage capacity of 328K and 256K respectively.

The FDS 1000 is based on the Z80A microprocessor and boasts 64K of RAM and 2K of ROM. It is a CP/M machine supporting such high level languages as BASIC, FORTRAN, Pascal and COBOL. The keyboard is separate from the main unit as with the MBC models.

The MBC 2000, the MBC 3000 and the FDS 1000 are priced at £2,950, £4,650 and £1,600 respectively. Further information is available from Sanyo Marubeni (UK) Ltd, 8 Greycaine Road, Greycaine Estate, Watford, Herts WD2 4QU. Telephone enquiries should be made on 0923-46363.

WHERE TO DRAW THE LINE ▼

Utilising a 6 MHz, Z80B processor, the Vector Graphics 5032 is available with an eight inch Winchester disc drive of 32M and the ability to support up to five terminals.

The 5302 system, priced from £9,125, offers true multitasking capability with Vector's own extended CP/M operating system. In addition, the 5032 comes complete with a standard software package which includes Microsoft BASIC-80, SCOPE (editor) and ZSM (assembler). The system will also run other standard CP/M-compatible software with very few exceptions.

For further information on the 5032 or the other Vector Graphic systems write to Almarc Data Systems Ltd, Great Freeman Street, Nottingham NG3 1FR or 'phone them on 0602-52657.



USING YOUR DIGITS ▶

An A4 sized portable digital graphics plotter is now available which, like the PL4 XY recorder, can accept digital commands via an IEEE-488 interface bus.

The PD4 plotter can also be supplied with a comprehensive software package for those users who own a Commodore PET. The software, supplied in ROM form, also extends the list of commands to the BASIC interpreter.

The pen can move at over 600 mm/sec and the plotter will recognise off-scale data causing the pen to be raised automatically. The plotter comes complete with an instruction manual containing sample programs and clear guidance on how to program the instrument for a variety of purposes.

Priced at £596 + VAT, the PD4 plotter is manufactured by JJ Lloyd Instruments Ltd, Brook Avenue, Warsash, Southampton SO3 6HP; telephone them on 048-95 4221.

A SHADY DEAL?

Available to fit most standard VDUs and mounting arrangements, Homalite low reflectance, contrast enhancement filters are claimed to reduce the problems associated with operator fatigue, eye strain and operator error.

Homalite filters have a low reflectance surface cast into the filter — it is not laminated so it cannot chip or peel. For optimum contrast and improved readability, Homalite filters are colour-matched to a range of specific colours.

If you want to know more about Homalite filters get in touch with SGL International, 76 Euclid Avenue, Haddonfield, New Jersey 08033, USA and ask them to send you the engineering bulletin they have published on the subject. You could always 'phone them on 609 429-7400 but please don't forget the code for the USA (010).

UNDER THE BED

KGB Micros have been appointed a dealer for the OKI IF800 colour graphics computer, a system aimed at technical, engineering and scientific users.

Driven by a Zilog Z80A eight-bit chip under the CP/M operating system, the IF800 has 64K of RAM (expandable up to 256K) and can be supported by a 4K ROM cartridge.

The system includes a



QWERTY keyboard, a built-in printer and a screen which can be switched from either eight-hue colour mode to monochrome green mode. Also, to back the central processor, the IF800 has two 400K 5¼" double sided, double-density mini floppy disc drives.

On the software side, the OKI system comes complete with an Extended BASIC interpreter; the IF800 can also handle Microsoft BASIC and Fortran.

The OKI IF800 is priced at £4,750 and is available from KGB Micros Ltd, 14 Windsor Road, Slough, Berkshire SL1 2EJ or telephone 0753-38310.

ARE YOU SITTING COMFORTABLY? ▼

Baseline is a range of ergonomically designed furniture

for use with computer peripherals, word processors and data processing terminals.

Every item in the range of desks, tables, work platforms, shelves and pedestals is available in either teak, mahogany or real beech wood finishes, all with rounded hardwood edging for durability. All electrical wiring and machine connecting leads can be contained neatly within the desks.

There is too much in the range to give you a good idea of the prices but according to the manufacturers, Baseline should be just 5% of your computer hardware expenditure. If you need more details the best thing would be to write to WH Deane (High Wycombe) Ltd, Wooburn Green, High Wycombe, Bucks HP10 0HH or telephone them on 06285-25011.





ZX-81



QS DEFENDER.

UP - DOWN - THRUST - FIRE
First and only full screen display.
Software to drive QS SOUND BD.
Moving Planetary surface. Up to
84 fast moving characters on
screen at once. On screen scoring.
Ten missiles at once. Increasing
attack patterns. Requires 8K
ROM, and 4K min of RAM. **£5.50.**

QS SOUND BD.

A programmable sound effects
board using the AY-3-8910. 3
TONES; 1 NOISE; ENVELOPE
SHAPER. + TWO 8 BIT I/O PORTS.
Easily programmable from
BASIC, the AY chip does most of
the work leaving your computer
free for other things. Signal O/P
via 3.5 mm Jack socket Ports O/P
via a 16 pin I.C. Socket. **£26.00.**

QS CHRS BD./

A programmable character
generator giving - 128 SEP-
ARATELY PROGRAMMABLE
CHARACTERS. ON/OFF SWITCH.
1K ON BOARD RAM. Enables
creation and display of your own
characters to screen or printer.
Demo cassette of fast machine
code operation routines and lower
case alphabet included. See below
for ZX PRINTER listing. **£26.00.**

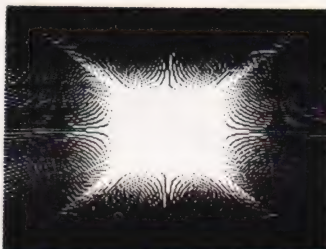
QS - LOWER CASE

abcdefghijklmnopqrstuvwxyz



QS INVADERS.

LEFT - RIGHT - FIRE
13x7 INVADERS; High score; 3
levels of play; RND saucers; Bonus
base; Drives Sound bd. & CHRS bd.
Requires 7K RAM, 8K ROM + Slow.
£5.50.



QS HI-RES BD.

A Hi-res graphics board giving -
256 x 192 PIXELS. 6K ON BD.
RAM. SOFTWARE SELECT/
DESELECT. MIXED TEXT AND
GRAPHICS. 2K ON BOARD ROM.
Resident fast machine code
graphics software (in ROM)
provides the following HI-RES
Commands. - MOVE x, y; PLOT x,
y; DRAW x, y; BOX x, y; UP; DOWN;
LEFT; RIGHT; PRINT A\$; SCROLL;
BLACK; WHITE CLEAR COPY. See
above for ZX PRINTER listings
using COPY. **£88.00.**

ZX-80



QS ASTEROIDS

LEFT - RIGHT - THRUST - FIRE
Software to drive QS SOUND BD.
Multiple missiles firing in 8
directions. On screen scoring.
Increasing number of asteroids.
Full mobility of ship to all areas of
the screen. Two asteroid sizes.
Bonus ship at 10,000 points.
Requires 8K ROM, 4K min of RAM
+ SLOW function. **£5.50.**

QS 3K RAM Bd.

An extremely reliable static RAM
Bd. which combines with the
computer's memory to give 4K
total. Plugs direct in to the rear
port on your ZX Computer.
£15.00.

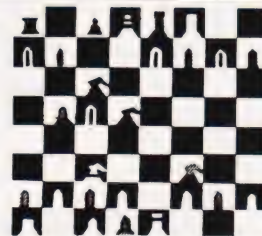
QS MOTHER BOARD BD. & QS CONNECTOR.

A reliable expansion system
allowing a total of any RAM pack
plus two other plug in boards to be
in use at once. On board 5V
regulator drives all external
boards. Fitted with two 23 way
double sided edge connectors.
Connector is 2x23 way edge
conns soldered back to back.
Expansion can operate in two
ways - (1) COMPUTER ↔
CONNECTOR ↔ Any QS add on bd.
(but no extra RAM pack). (2)
COMPUTER ↔ CONNECTOR ↔
MOTHER BD ↔ ANY RAM PACK.
(2 bds to fit in mother bd.) Mother
board **£12.00** Connector **£4.00.**

Special offers & news

(1) QS Mother bd. + connector + CHRS bd. + The special Graphics version of
ARCTIC COMPUTING'S ZX CHESS 11. £45.00.
The strongest chess program with 7 levels of play.

(2) QS MOTHER BD + CONNECTOR + either SOUND or CHRS bd. **£40.00.**



POSTAL AND MONEY ORDERS TO:

QUICKSILVA: 98, UPPER BROWN HILL RD. : MAYBUSH : SOTON : HANTS : ENGLAND.

Please state Type of machine, Which ROM, Memory size, when ordering.

ALL PRODUCTS FULLY GUARANTEED.

A & F SOFTWARE

THE CYLONS HAVE ARRIVED



FOR ATOM USERS

G0104 CYLON ATTACK: This 3D all action game in high resolution graphics, takes you into the Science Fiction world of Interstellar Wars.

Strapped in a Starfighter, looking out into the void of space, you glance at the instruments, the long range scanner has the CYLONS pinpointed. You select the nearest target and turn to meet it ready to defend Earth to the end!!!

In keeping with our Companies pricing policy on all ATOM GAMES SOFTWARE this REMARKABLE game is only £4.95

G0105 ROBOT NIM Perhaps the most entertaining and novel versions of this classic puzzle available. Watch the antics of the Robot as you vie with Atom for control of the game. Offered at the give-away price of only £3.95

5K Text 6K Graphics

Special Offer! Deduct £1.00 per additional cassette when ordering two or more programs

ORDERS TO:

**A & F SOFTWARE, 10 WILPSHIRE AVENUE,
LONGSIGHT, MANCHESTER M12 5TL
24 HOUR TELEPHONE ORDERS ON 061 320 5482**

Orders normally dispatched within 72 hours
Please enclose a SAE with enquires
Co. Reg. No. 2771093

ATOM UK 101-SUPERBOARD

OTHER TITLES FOR THE ATOM

G0100 POLECAT: Avoid being eaten by the Polecat searching the maze for your 5K Text 6K Graphics . . . £4.95

G0101 EARLY WARNING: Destroy the attacking ICBM's using a realistic radar display & intercept missiles. 48 levels: Sound: Score & Screen Counters 4K Text 6K Graphics . . . £4.95

G0102 MINEFIELD: Watch out for chain-reactions as you clear the mines with your tank. Each mission becomes harder! Sound: Score & High Score: 5K Text ½K Graphics . . . £4.95

G0103 TANGLED: Challenge your friend or the atom to this game, the more you score the harder you find the game: 4 Skill Levels: Individual & Highest Scores Displayed 5K Text ½K Graphics . . . £3.95

G0106 MISSILE COMMAND: Fast moving hi-res version of the popular arcade game. 5K text 6K graphics . . . £4.95

G0107 ATOMIC CUBE: 3D Version of the popular puzzle, hi-res colour graphics can you solve it. 5K Text 6K Graphics requires floating point . . . £3.95

G0108 POLARIS: Your submarine is ordered to sink an enemy convoy, can you complete your mission before being destroyed by the escorting warships. 5K Text, 6K Graphics . . . £3.95

G0109 PONTOON: The inexpensive way to lose at cards — This is the last in a series of card games. We are publishing for the Atom can you break the bank and beat the Atom hi-res graphics display. 5K Text, 6K Graphics . . . £3.95

UK 101 SUPERBOARD GAMES

S0100 MADMAN. Watch out for the Guardians as you travel the maze collecting points and bonuses. Can you beat the high score so far — 141,600? M. Hickling. Runs in 8K. Priced at **£4.95.**

S0101 LUNAR LANDER. min in 8K

£3.95

S0102 PONTOON

£3.95

We pay 25% royalties on Atom — UK101 — SUPERBOARD and NASCOM II PROGRAMS — PHONE FOR DETAILS.



THE SYMBOL OF VALUE

NASCOM

| | |
|--|---------|
| KITS | |
| Nascom 1, with NAS-SYS 1 less PIO | £112.50 |
| Nascom 2, no user RAM | £202.50 |
| BOARD LEVEL | |
| Nascom 1, with NAS-SYS 1 less PIO | £126.00 |
| Nascom 2, no user RAM | £238.50 |
| CASED SYSTEMS | |
| Nascom 3, no user RAM | £338.40 |
| 8K user RAM | £36.00 |
| 16K user RAM | £90.50 |
| 32K user RAM | £103.50 |
| 48K user RAM | £117.00 |
| POWER SUPPLY | |
| Kit form | £29.25 |
| MEMORY CARDS | |
| RAM B memory card with 16K RAM — kit | £72.00 |
| RAM B memory card with 16K RAM board | £90.00 |
| Additional 16K RAM | £13.50 |
| Additional 32K RAM | £27.00 |
| I/O BOARDS | |
| I/O boards for 3 x PIO, 1 x CTC, 1 x UART (kit) ex PIO | £40.50 |
| PIO for above I/O | £10.80 |
| CTC for above I/O | £12.60 |
| UART for above I/O | £14.40 |
| DISC SYSTEMS | |
| Nascom single disc drive (350KB) incl. FDC card | £423.00 |
| Nascom dual disc drive (350KB each) incl. FDC card | £616.50 |
| NAS DOS disc op system | £40.50 |

SOFTWARE

| | |
|---------------------------|--------|
| NAS-SYS 1 ROM | £10.80 |
| NAS-SYS 3 EPROM | £18.00 |
| ZEAP 2.1 for NAS | £26.30 |
| SYS in 4 x EPROM | |
| ZEAP 2.1 for NAS | £22.50 |
| SYS on tape | |
| 8K microsoft basic in ROM | £18.00 |

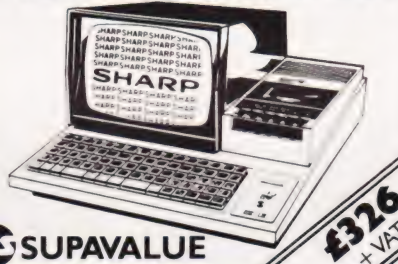
ATARI

| | |
|-------------------------------|--|
| 800 Computer | |
| 400 Computer | |
| Recorder | |
| Disk Drive | |
| 16K RAM | |
| Joysticks (pair) | |
| Blank Diskettes (5) | |
| Assembler Editor | |
| Space Invaders (ROM) | |
| Star Raiders (ROM) | |
| Missile Command (ROM) | |
| Asteroids (ROM) | |
| Invitation to Programming (1) | |
| Invitation to Programming (3) | |
| Touch Typing | |
| Conversational French | |
| Conversational German | |
| Conversational Spanish | |

TAPES

| | |
|----------------------------|-------|
| Blank C12 | £5.00 |
| Tapes (6 mins/side) for 10 | |

SHARP MZ80K (48K RAM)



SUPAVALUE

£326 + VAT

SHARP PC1211



SUPAVALUE

£60 + VAT

ATARI 800 (16K RAM)



SUPAVALUE

RING FOR OUR SUPA LOW PRICES

CBM VIC

| | |
|-------------------|--|
| VIC 20 | |
| VIC Cassette Unit | |
| VIC Printer | |
| VIC Disk Drive | |
| 3K RAM Cartridge | |
| 8K RAM Cartridge | |
| 16K RAM Cartridge | |
| Programmers Aid | |
| Machine Code | |
| DISK | |

| | |
|-----------------------|--|
| VIC SOFTWARE | |
| Introduction to Basic | |
| Avenger (ROM) | |
| Super Slot (ROM) | |
| Alien (ROM) | |
| Super Lander (ROM) | |
| Road Race (ROM) | |

BOOKS

| | |
|--|--------|
| Computers for Everyone | £6.00 |
| Science & Eng | |
| Prog Apple II Ed | £11.60 |
| Apple BASIC Data | |
| File Programming | £8.95 |
| Make a success of Micro-computing in your Business | £4.95 |
| Inside BASIC Games | £11.50 |
| Intro to PASCAL | £11.50 |

RING FOR SUPA LOW PRICES.

| | |
|---|--------|
| PASCAL H'book | £13.95 |
| Program the Z-80 | £11.95 |
| Your First Computer | £7.75 |
| 6502 Applications Book | £10.25 |
| Advanced BASIC | £8.95 |
| Apple II User's Guide | £11.10 |
| Basic BASIC | £8.95 |
| BASIC Business Software | £7.05 |
| BASIC Computer Games | £5.95 |
| BASIC Comp Progs in Science & Eng | £8.55 |
| BASIC with style | £6.95 |
| BASIC A self teaching guide | £5.95 |
| CP/M User's Guide (Osborne) | £10.10 |
| Game Playing with BASIC | £8.20 |
| Getting acquainted with your Acorn Atom | £7.95 |
| Instant BASIC | £8.75 |
| Micros Vol 0 | |
| Beginner's Book | £3.50 |
| Micros Vol 1 | |
| Basic Concepts | £10.10 |
| Microsoft BASIC | £8.75 |
| More BASIC Games | £6.25 |
| Mostly BASIC | |
| Applies Apple II | £7.95 |
| Mostly BASIC | |
| Applies PET | £7.95 |
| Programming a Micro — 6502 | £8.05 |

YOU'LL VALUE OUR EXPERIENCE YOU'LL VALUE OUR PRICES

ACCESS & BARCLAYCARD WELCOME — HIRE PURCHASE & PART EXCHANGE AVAILABLE ALL PRICES EXCLUDING VAT 1 & D 1

SRS MICROSYSTEMS
161 Bramley Road, Oakwood, London N14 4XA.
Telephone: 01-363 8060.
Open Mon-Sat. 9-5.30.



FREE SECURICOR DELIVERY

BUILDING ON A MICRO

Personal Programmer is a package providing users with an easy way to create custom application programs through an English language interaction without the need to see any program code.

By designing a data entry screen directly on to the VDU, the user can generate a program to handle that input data. In a similar way, by designing a report layout on the screen the package will generate a program to produce that report. The time taken to develop a simple one file, one report program will obviously depend on your typing skill but the package's program generation time is something between 20 seconds and two minutes.

For more information on Personal Programmer or the rest of the Pearl range of business software, contact Pearl Software, Audley Lodge, Glenair Road, Parkstone, Dorset.

WHAT'S THE WORD ON THE TRS-80?

A word processing package called Newsript has been introduced for the TRS-80 Models I and III; the package requires 48K with at least one disc drive to operate efficiently.

Using Newsript, text can be entered, material added or deleted, lines moved around or duplicated and 'global' changes easily carried out. The package also includes features such as centering, right-justification, page numbering and mail-merge.

Supporting most matrix and daisywheel printers, the Newsript package comes complete with a 160 page manual which incorporates a simple self-study tutorial and a reference card.

Newsript is priced at £79 + VAT + post and packing from EA International, 8 High Street, Meldreth, Royston, Herts SG8 6JU.

STOCKING UP

Saba Computer Systems have released the Saba Stock Control system, a package based on Triumph Adler's Alphatronic microcomputer.

Providing a menu-driven format, the program guides the operator step-by-step through all operations using clear prompts to avoid any error routines. The package itself will control up to

1,700 records per disc and, depending on whether one or two single- or double-sided discs are used, a storage of up to 6,800 records can be achieved.

The Stock Control program is available as a stand-alone package for £350 or it can be integrated with the Saba Sales Ledger system, a package which performs all sales accountancy tasks. The Sales Ledger also costs £350.

For further details get in touch with Triumph Adler UK Ltd, MMD, 27 Goswell Road, London EC1M 7AJ or telephone them on 01-250 1717.

COMPUKIT CATALOGUE

A free catalogue detailing some of the latest software for the CompuKIT UK101 can be yours if you write to Arcadia Software, 4 Chestnut Avenue, West Cross, Swansea SA3 5NL.

Among the 8K programs included are Space Fighter and Asteroids, priced at £3.95 each, Invaders at £2.95 and Chicane Chaser and Astro Sled both priced at £1.95. There is also a 4K Games Pack containing four old favourites priced at £2.95.

All the 8K programs contain sound effects routines for AY-3-8910 or AY-3-8912 based programmable sound generators.

IT'S GOT TO BE DANISH!

Metanic COMAL-80, a high level language from Denmark, is now available on the MultiBoard system.

COMAL-80 contains, besides the full Extended BASIC command set, a number of the structures found in Pascal. With built-in programming support, COMAL-80 is a relatively easy language to learn and debug but, unlike other beginner's languages, it supports a set of structured statements such as IF...ELSE...ENDIF, REPEAT...UNTIL, WHILE...ENDWHILE and CASE...WHEN...ENDCASE which allow the user to define and handle any group of statements as one block.

Each of the two different COMAL-80 packages (one version leaves more storage for the user and takes up a few seconds at the start and end of the program execution for reading the overlay) contains two versions of the COMAL-80 interpreter. Both packages are available on tape or 5¼" disc at £100 + VAT each from any MicroValue dealer.

Further details and a list of dealers may be obtained from Gemini Microcomputers Ltd, Oakfield Corner, Sycamore Road, Amersham, Bucks. Telephone enquiries should be made on 02403-28321.



SOFT WARES

OPERATING IN A DESERT? ▶

How are you coping with your Kontron PSI 80? Maybe you could do with the operating system developed by Phase One Systems Inc called OASIS.

Useful for various laboratory, scientific and commercial applications, the OASIS program development facilities also enhance the graphics capabilities of the Kontron, utilising the 512 x 256 pixel resolution.

Among the options available using OASIS are CONTROL Relational DBMS, File Sort Utility, Bi-Sync 2780/3780 and an IBM 3740 formatter as well as FORTH, FORTRAN, RM COBOL and Pascal languages.

For more detailed information concerning implementation and price contact Kontron Computers at Kontron House, Campfield Road, St Albans, Herts AL1 5JG or 'phone them on 0727-66222.

APPLE TRIO ▼

Just when you thought you had everything for your Apple III they go and bring out more and more. Sigh!

The first of the three new packages is called Access III and is priced at £90 + VAT. Access III is a data communications application which enables the user to handle a stand-alone and timesharing tasks.

The second package is called PUL (Pascal Utilities Library) which makes Pascal programming that much easier on the Apple III. Last up is Script III, a professional text editing package enabling the user to format and add style to printed Pascal text files. The price of PUL and Script III are £45 + VAT and £75 + VAT respectively.

More information is available from Apple Computer (UK) Ltd, Finway Road, Hemel Hempstead, Herts HP2 7PS or by telephone on 0442-40573.



SAFE WARES?

A protection package called SAFEWARE is now available for those of you wishing to develop or sell software and protect it from unauthorised access or copy.

This two part package comprises a small hardware unit (a doug) which plugs into the PET user port and a software interrogation routine. The software routine, placed anywhere within the user's program, checks for the presence of the hardware unit and if absent, inhibits the program. Each SAFEWARE package is individually coded and users are allocated a unique code for each application or commercial software package.

Each SAFEWARE package costs £19.95 and is treated in the strictest confidence. For further details contact David Walker at Mektronic Consultants, Linden House, 116 Rectory Lane, Prestwich, Manchester M25 5DB or telephone him on 061-798 0803.

BARGAIN BYTES

The first of a series of cassettes for the 16K ZX81 has been released offering in excess of 50K of programs combining both 'serious' and 'pleasure' software.

Bargain Bytes 1, like the others to follow, comprises eight programs ranging from Deep Sea Adventure and Underground Adventure to Bank Account and a Foreign Currency Converter. Soon to be released is Bargain Bytes 2 which will include Home Budgeting, a stock marketing game and a seafaring game.

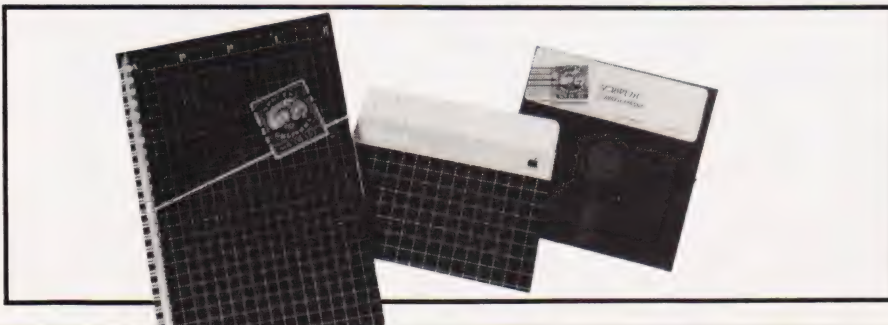
Priced at £5, including post and packing, Bargain Bytes 1 is available now from Richard Shepherd Software, 22 Green Leys, Maidenhead, Berks SL6 7EZ. Telephone enquiries can be made on 0628-21107.

FOOTBALL CRAZY

Remember Professor Frank George's F4 Football Forecast Program from Sporting Forecasts which was available for the Apple, PET, Sharp, TRS-80 and Video Genie at £28.75. Well, there's now a 16K cassette version offered for the PET, TRS-80 and Video Genie at £19.95.

And not only that, they've also released another program which provides the maximum possible coverage of forecast drawn games within the cash available and it's called POOLPERM. This new program is currently available as a 32K disc version for the Apple, PET, Video Genie and TRS-80 and as a 16K cassette version for the PET, Sharp, Video Genie and TRS-80. All are priced at £17.25.

The programs are supplied with a comprehensive booklet and can be obtained from the Bureau of Information Science, Commerce House, High Street, Chalfont St Giles, Bucks HP8 4QH. For further information you could always 'phone them on 02407 4906.



NEXT MONTH

ADVANCED BBC PROGRAMMING

Having received your BBC Micro, worked through the Welcome pack and dipped into the manual, you might be wondering what to do next. Well, if you get hold of next month's issue of Computing Today, you'll find a major feature on advanced programming techniques you can use with this versatile system.

The article will be essential reading for those who are merely *thinking* of buying the system too, as it is intended to show up some of the machine's great strengths over systems supplied with ordinary or Extended BASICs. Indeed, if you are at all interested in producing good, structured pieces of software then this feature is going to be well worth waiting for.

ADDING UTILITIES TO YOUR NASCOM

As well as being one of the very first British personal micros, the NASCOM has always been one of our personal favourites. In our next issue we take a look at how you can build a powerful set of utilities which, unlike the commercial 'toolkits', can be configured to suit your own special needs. Indeed, if you take the ideas presented here far enough you could end up with your own special version of BASIC tailored to your own requirements.

SOFTWARE GALORE

Our July issue will also contain a bonus of some eight pages of Softspot material. These are reader's own programs submitted to the magazine and you can be sure that we have picked out some of the more interesting or fun-to-use material from the vast piles sent in over the last few months.

HANDS-ON A HAND-HELD

If you thought that the PC-1211 was a great little machine, and few didn't, just wait till you read our report on the amazing PC-1500. Quite apart from its in-built features, it is backed up with a number of interesting extras including a four-colour printer which simply has to be seen to be believed.

For a look at advanced pocket programming power, you simply can't afford to miss out on our next issue.



WATCHING TANDY'S BASIC AT WORK

The single major failing of most debugging aids you can buy for your system is that they only show you what your program is doing. This program actually shows you what the interpreter is doing to your program, with a real-time screen display of those vital scratchpad locations.

If you're bugged by bugs you can't track down, try adding this utility to your library and see just where they are wrecking your code.

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

NAME
ADDRESS
Please reserve me a regular copy of Computing Today

GIVE THIS TO YOUR NEWSAGENT

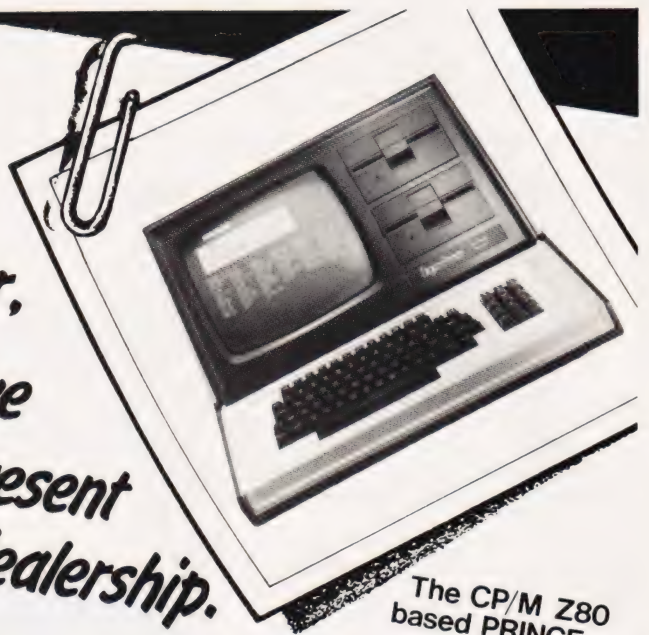
JULY ISSUE ON SALE
FRIDAY 11th JUNE

SOFTWARE... SOFTWARE... AT HOME... IN BUSINESS

Computing Today

ONLY 70p

**Dear
Computer Dealer,
We may well have
obsoleted your present
micro computer dealership.**



**The CP/M Z80
based PRINCE**

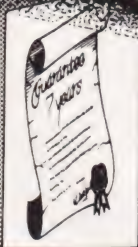
If your present micro supplier:

1. Does not carry a seven year maintenance guarantee.
 2. Is not supported by an established British manufacturer with over 16 years computing experience.
 3. Does not offer your users a growth capability.
 4. Does not offer a minimum interruption plan during breakdown.
 5. Does not provide comprehensive support for its dealers.
- then you could well be dealing with the wrong supplier.

Your micro checklist

- **First class dealer support.**
We provide comprehensive sales support - sales expertise, local seminars, exhibitions, publicity, sales aids, training and consultancy.
- **Provides for growth**
By linking you to powerful mini systems and permit you to develop a real big system capability.
- **Maintenance for seven years**
Offering a **seven year maintenance guarantee*** the Digico Prince provides the 'coming of age' seal to the micro industry.
- **Backed in Britain**
Digico Computers have been in the business of computer hardware design, manufacture and maintenance for over sixteen years. With factories in Leeds and Stevenage, the Prince is fully supported in the United Kingdom.
- **Excellent value rental scheme**
For complete turnkey systems which include maintenance. (Dealer commission paid up front in full)
- **Minimum Interruption Plan (MIP)**
If your Prince goes down, we'll exchange it for a replacement to keep you running - **all in the rental price!**
- **Keep up with technology**
Digico Computers have enabled their users to keep pace with technology since 1966.
- **Ready made accounting**
No development cost - just buy proven packages covering sales, purchase and nominal ledgers plus stock control, order entry, payroll, word processing, full graphics and supercalc.
- **Ideal for new computer users**
Maximise their learning on a minimum investment and then link them up to larger systems when they're fully familiar and ready to grow.

We're looking for the sort of distributor that can sell a real business machine and not leave the user to the mercy of a plaything.



**MAINTENANCE
FOR
SEVEN
YEARS**

REAL SUPPORT



**BACKED
IN
BRITAIN**



**IDEAL
FOR NEW
COMPUTER
USERS**

digico

MICRO DIVISION
Arena House
46 Broadway
Letchworth
Herts. SG6 3BX
Tel: (04626) 78172

* Providing there is a maintenance contract continuously from new

Assembly language programming can seem a real drag until you take advantage of the facilities offered by a package such as this.

A two-pass assembler is a virtual necessity for anyone wanting to start to write complex, well-designed programs at machine code level. The main differences between a two-pass assembler and the more common line-by-line assembler are:

- 1) A copy of the source code (the assembly code you've typed in) is always retained as a file.
- 2) Any location or instruction can be given an alphanumeric label up to 10 characters in length. All characters in the label are significant and it must start with a letter.
- 3) These labels may be used in the operand — that's the address or data section of an instruction. For example, you could label the address 0400 Hex as SCREENTOP and then JMP SCREENTOP. You can also label values so that CHARACTER = \$A0 and, where you wanted to load the value A0, use the label CHARACTER instead.

The overwhelming advantage of a two-pass label based system is that instructions or even whole blocks of program can be altered, amended or added to without worrying about changing the addresses as all this is done by the assembler.

The program published here is disc-based and runs on the Commodore 8032 system. The source program must, therefore, reside on disc and the compiled program will be loaded back onto disc. The compiled version can then be loaded off disc and run as required. It would, of course, be a relatively simple matter to convert the program to work with Commodore's cassette system or, if you are feeling really adventurous, to use two cassettes.

Facilities Available

A number of useful features are built into the program and these are as follows:

- 1) Assembly may start at any address.
- 2) All standard 6502 instructions and addressing modes are supported.
- 3) Zero Page instructions are automatically created where possible to speed up execution.
- 4) Three types of constant are supported:

Right: The Editor program showing the command menu and a program listing retrieved from disc.

Below: The Assembler display once the above program has been assembled. The start address of 0 causes a pseudo-BASIC program to be generated.

```

start address (decimal)? 0

pass 1

pass 1 completed.
start address: $040f
end address: $0419

pass 2

character = 'a'
screentop = 32768
start lda #character
loop ldx #0
sta screentop,x
inx
bne loop
rts

.end

assembly complete

ready.
    
```

```

commands available list
                    exit
                    save
                    load

(enter these as separate command lines)

label mn. operand comment

"5 character = 'a
"10 screentop = 32768
"15 start lda #character
"20 ldx #0
"25 loop sta screentop,x
"30 inx
"35 bne loop
"40 rts
"
    
```

```

Hex LDA # $41
Decimal LDA # 65
ASCII LDA # 'A
(These all produce A9 41)
    
```

The assembler is written in BASIC to aid conversion to other systems; features unique to the Commodore 8032 and the 8050 discs will be dealt with later.

A SYS call to execute the object code automatically can be created so that the machine code program can be RUN from BASIC.

Using The Assembler

In order to demonstrate the use of the two-pass assembler we'll take the following program as an example:

```

CHARACTER = 'A
SCREENTOP = 32768
START LDA #CHARACTER
LDX #0
LOOP STA SCREENTOP,X
INX
BNE LOOP
RTS
    
```

The value of LOOP will automatic-

ally be assigned to the address of the instruction STA SCREENTOP,X at assembly time. This version of the EDITOR program will automatically insert the .END statement when the source code is saved on disc.

To create a source file of this program, load the EDITOR program and, after RUNNING it, enter the program as if it were BASIC; that is with a line number in front of each line. The apparently spurious '#' symbol at the beginning of each line is inserted by the EDITOR to allow the use of commas in the operand field. If this symbol were not present the BASIC interpreter would take commas as being data separators with somewhat disastrous results.

The EDITOR uses a scrolling window on the screen of the 8032; the top section of the screen is reserved for the command menu and also shows the fields into which your assembly code should be typed. The TAB key will move the cursor to the next location; this is important as the EDITOR is very fussy about where things appear. There is always an empty field available at the extreme right for

TWO-PASS ASSEMBLER

comments.

To list the program, type 'list' as your input line; typing 'save' will initiate a save sequence and ask for a filename, 'load' will allow you to enter another piece of source code from disc and 'exit' will exit the EDITOR. The EDITOR will automatically append the suffix .SRC to the filename of any program you save.

It is important to note that the line numbers you have typed in at the beginning of each line are not saved on the disc file so, when you load the source code back into the EDITOR, you will find that the new line numbers are neatly incremented in 5s.

Getting Assembled

Once you have entered the source code and saved it on disc, you can start to assemble it. LOAD the ASSEMBLER program and RUN it. Although this program takes several seconds to set up its arrays, it displays the various mnemonics as they are loaded rather than leaving a blank screen to stare at.

Once the set-up procedure has been completed, the program asks for the filename of the program you wish to assemble. In much the same way as the EDITOR appended the suffix .SRC, the ASSEMBLER appends .OBJ to the filename of the object file. If the filename specified is not found on the disc currently installed in drive 0 the program will stop.

Assuming all is well, the program then asks for the start address of the assembled code and this should be entered in decimal form. If address 0 is entered the assembled code will start with the line

```
10 SYS(1039)
```

at the beginning of the object file which will then be followed by the machine code. As 1039 is the first available address in the Commodore's memory after the one line of BASIC, the program can simply be LOAded and RUN.

The first pass through the source file by the ASSEMBLER will now be executed and this collects all the labels and produces a table of their values. The pass also determines the number of bytes in each instruction as this value will be needed to calculate the label addresses.

If no errors are encountered the second pass is now executed actually creating the object file. A full

assembly code and Hex dump is produced on the screen as this pass works through the program. When the source code has been fully assembled the files are closed and the operation complete.

Some Rules Of Syntax

In order to simplify the programs, a number of syntax rules have been established. These are:

- 1) There must be at least one space between labels and instructions and between instructions and their operands.
- 2) Comments must be preceded by a semi-colon (;).
- 3) Hexadecimal values are prefixed by \$.
- 4) Decimal values need no prefix.
- 5) ASCII values must be prefixed by a single apostrophe (').

| Line | Function |
|-----------------|---|
| Line 120 | Contains the number of bytes in instructions with each different addressing mode, in the order: IMMEDIATE ABSOLUTE ZERO-PAGE ACCUMULATOR IMPLIED (INDIRECT), X (INDIRECT), Y ZERO-PAGE, X ABSOLUTE, X ABSOLUTE, Y RELATIVE (INDIRECT) ZERO-PAGE, Y |
| Line 130 | Sets up the arrays: IN\$(X) = List of mnemonic instructions OP%(X,Y) = Op codes H\$(X) = Decimal to Hex conversion NB%(X) = Number of bytes for each addressing mode L\$(X) = List of labels L%(X) = Addresses of labels |
| Lines 180-340 | Set up the op-code and Hex tables. |
| Lines 390-410 | Determine the filenames. |
| Lines 420-440 | Determine the assembly start address. |
| Line 450 | Opens the source file to read; an equivalent CBM 3000 PET command is: OPEN 1,8,2,"0:" + FS\$ + ",S,R" |
| Line 470 | Aborts if the file is not found. DS on an 8032 computer is set to a number > 19 if a disc error is encountered. |
| Lines 500-680 | Perform Pass 1 — a table of the labels and their values from the source file is created. The equivalent of 700 DCLOSE is 700 CLOSE 1. |
| Lines 700-780 | Display the start and end addresses. |
| Lines 800-1160 | Perform Pass 2. |
| Line 810 | Scratches any existing object file of the same name as the one specified. |
| Lines 860-890 | Send the tokenised BASIC line 10 SYS(1039) to the object file if necessary. |
| Lines 930-940 | Send the start address of the object code to the file. |
| Lines 960-1160 | Assemble the source code. |
| Lines 1180-1270 | Convert a Hex string H\$ into a decimal value H. |
| Lines 1290-1320 | Convert the decimal value H into a four-digit Hex string H\$. |
| Lines 1340-1370 | Convert the ASCII string H\$ into the decimal value H. |
| Lines 1390-2140 | Determine the addressing mode (AM) of an instruction and evaluate its operand to a value in H. (GOSUB 21000 to execute.) |
| Lines 2160-2400 | Determine the full machine code version of an assembly language instruction. |

```

100 TS=CHR$(137):REM ** TAB SET/RESET FUNCTION
110 QS=CHR$(34):REM ** DOUBLE QUOTES CHARACTER
120 DIM LS(500,4):REM ** MATRIX TO HOLD ASSEMBLY CODE
130 MX=0:REM ** PROGRAM LINE COUNTER
140 PRINT CHR$(147):REM ** CLEAR SCREEN
150 REM ** CLEAR OLD TABS
160 PRINT CHR$(9);
170 IF POS(0)<>79 THEN PRINT TS$:GOTO 160
180 PRINT
190 REM ** SET NEW TABS
200 PRINT TAB(6);TS;TAB(16);TS;TAB(20);TS;TAB(41);TS
210 PRINT CHR$(147);"COMMANDS AVAILABLE: LIST"
220 PRINT "[10 SPC]EXIT"
230 PRINT "[10 SPC]SAVE"
240 PRINT "[10 SPC]LOAD"
250 PRINT
260 PRINT "ENTER THESE AS SEPARATE COMMAND LINES"
270 PRINT
280 PRINT CHR$(9);"LABEL";CHR$(9);"MN.";CHR$(9);
  "OPERAND";CHR$(9);"COMMENT"
290 PRINT
300 PRINT CHR$(15):REM ** SET SCROLLING WINDOW
310 REM ** GET A LINE OF TEXT FROM THE KEYBOARD BUFFER
320 POKE 158,2:POKE 623,34:POKE 624,27
330 OPEN 1,0:INPUT#1,AS:CLOSE 1
340 IF AS="" THEN 320
350 REM ** LINE NUMBER OR COMMAND?
360 CS=LEFT$(AS,4)
370 IF CS="LIST" THEN 510
380 IF CS="EXIT" THEN 600
390 IF CS="SAVE" THEN 630
400 IF CS="LOAD" THEN 770
410 L=VAL(CS):IF L>MX THEN MX=L
420 REM ** LOAD THE ARRAY ELEMENTS
430 LS=MIDS(AS,6,10):GOSUB 480:LS(L,1)=LS
440 LS=MIDS(AS,16,4):GOSUB 480:LS(L,2)=LS
450 LS=MIDS(AS,20,21):GOSUB 480:LS(L,3)=LS
460 LS=MIDS(AS,41):GOSUB 480:LS(L,4)=LS
470 GOTO 320
480 J=LEN(LS):IF J AND RIGHTS(LS,1)="[SPC]" THEN
  L=LEFT$(LS,J-1):GOTO 480
490 RETURN
500 REM ** LIST ROUTINE
510 PRINT CHR$(19);CHR$(147):REM ** CLEAR LOWER SCREEN
520 FOR X=1 TO MX
530 IF LS(X,1)+LS(X,2)+LS(X,3)+LS(X,4)="" THEN 560
540 PRINT CHR$(34);CHR$(27);MIDS(STR$(X),2);CHR$(9);
  LS(X,1);CHR$(9);LS(X,2);
550 PRINT CHR$(9);LS(X,3);CHR$(9);LS(X,4)
560 NEXT X
570 GOTO 320
580 REM ** CLEAR WINDOW AND END
590 REM ** EXIT ROUTINE
600 PRINT CHR$(19);CHR$(19);CHR$(147)
610 END
620 REM ** SAVE ROUTINE
630 INPUT "FILENAME";FS:FS=FS+".SRC"
640 SCRATCH(FS):IF DS>19 THEN STOP
650 DOPEN#1,(FS),W
660 IF DS>19 THEN STOP
670 FOR X=1 TO MX
680 IF LS(X,1)+LS(X,2)+LS(X,3)+LS(X,4)="" THEN 720
690 FOR Y=1 TO 4
700 PRINT#1,QS;LS(X,Y);QS
710 NEXT Y
720 NEXT X
730 PRINT#1,"END,...."
740 DCLOSE
750 GOTO 320
760 REM ** LOAD ROUTINE
770 INPUT "FILENAME";FS
780 FS=FS+".SRC"
790 FOR X=1 TO MX
800 FOR Y=1 TO 4
810 LS(X,Y)=""
820 NEXT Y
830 NEXT X
840 DOPEN#1,(FS)
850 IF DS>19 THEN STOP
860 X=0
870 X=X+5
880 FOR Y=1 TO 4
890 INPUT#1,LS(X,Y)
900 NEXT Y
910 IF ST=0 THEN 870:REM ** MORE TO COME
920 DCLOSE
930 LS(X,1)=""
940 LS(X,2)=""
950 LS(X,3)=""
960 LS(X,4)=""
970 MX=X
980 GOTO 510
100 PRINT CHR$(147):REM ** CLEAR SCREEN
110 REM ** DATA GIVES NUMBER OF BYTES FOR EACH
  INSTRUCTION
120 DATA 2,3,2,1,1,2,2,2,3,3,2,3,2
130 DIM INS(56),OP$(56,13),HS(255),NB$(13),LS(200),
  L$(200)
140 PRINT:PRINT
150 PRINT "PLEASE WAIT WHILE SETTING-UP IS DONE"
160 PRINT:PRINT
170 SET UP OP-CODE AND HEX TABLES
180 FOR X=1 TO 13
190 READ NB$(X)
200 NEXT X
210 FOR X1=1 TO 56
220 READ INS(X1)
230 PRINT INS(X1),
240 FOR Y1=1 TO 13
250 H=-1
260 READ HS
270 IF HS<>"--" THEN GOSUB 1180
280 OP$(X1,Y1)=H
290 NEXT Y1
300 NEXT X1
310 HS="0123456789ABCDEF"
320 FOR X=0 TO 255
330 HS(X)=MIDS(HS,X/16+1,1)+MIDS(HS,(X AND 15)+1,1)
340 NEXT X
350 PRINT CHR$(147)
360 PRINT "TWO-PASS ASSEMBLER"
370 PRINT
380 REM ** FILE NAME GENERATION
390 INPUT "FILENAME";FS
400 FSS=FS+".SRC"
410 FOS=FS+".OBJ"
420 INPUT "START ADDRESS (DECIMAL)";AD
430 SA=AD
440 IF SA=0 THEN AD=1039
450 DOPEN#1,(FS):REM ** OPEN FILE ON DISC
460 REM ** IF FILE NOT THERE STOP PROGRAM
470 IF DS>19 THEN PRINT DS:DCLOSE:STOP
480 PRINT
490 REM ** ASSEMBLE THE LABEL TABLE
500 PRINT "PASS 1"
510 GOSUB 2390
520 IF L1$=".END" OR L2$=".END" THEN 660
530 IF L1$="" THEN 630
540 IF LEFT$(L2$,1)<>"=" THEN 600
550 GOSUB 2040:IF AM<>2 THEN 2990
560 NL=NL+1
570 L$(NL)=L1$
580 L%(NL)=H-32768
590 GOTO 510
600 NL=NL+1
610 L$(NL)=L1$
620 L%(NL)=AD-32768
630 GOSUB 2160
640 AD=AD+NB
650 GOTO 510
660 DCLOSE
670 PRINT
680 PRINT "PASS 1 COMPLETED"
690 REM ** DISPLAY THE START AND END ADDRESSES
700 H=SA
710 IF H=0 THEN H=1039
720 GOSUB 1290
730 PRINT "START ADDRESS: $";H$
740 H=AD-1
750 GOSUB 1290
760 PRINT "END ADDRESS: $";H$
770 PRINT
780 PRINT
790 REM ** START TO ASSEMBLE PROGRAM
800 PRINT "PASS 2"
810 SCRATCH (FOS):REM ** ERASE PREVIOUS VERSION
820 OPEN1,8,2,FSS+",S,R"
830 OPEN2,8,3,"0:"+FOS+",P,W"
840 IF SA THEN 930
850 REM ** CREATE LINE OF BASIC [10 SYS(1039)]
860 PRINT#2,CHR$(1);CHR$(4);
870 PRINT#2,CHR$(13);CHR$(4);CHR$(10);CHR$(0);
880 PRINT#2,CHR$(158);"(1039)";
890 PRINT#2,CHR$(0);CHR$(0);CHR$(0);
900 SA=1039
910 GOTO 960
920 REM ** WRITE START ADDRESS TO DISC
930 HH=INT(SA/256)
940 PRINT#2,CHR$(SA-HH*256);CHR$(HH);
950 REM ** START ASSEMBLY PROPER
960 AD=SA
970 GOSUB 2390
980 IF L1$+L2$+L3$+L4$="" THEN 970
990 PRINT:PRINT L1$,L2$,L3$,L4$,TAB(52);
1000 H=AD
1010 GOSUB 1290
1020 PRINT H$,
1030 IF L1$=".END" OR L2$=".END" THEN 1130
1040 IF L2$="" THEN NB=0:GOTO 970
1050 GOSUB 2160
1060 IF NB=0 THEN 1110
1070 PRINT#2,CHR$(01);

```

Listing 1. The EDITOR program for the two-pass assembler.

TWO-PASS ASSEMBLER

```
1080 PRINT HS(01);"[SPC]";
1090 IF NB>1 THEN PRINT#2,CHRS(02);:PRINT HS(02);"[SPC]";
1100 IF NB>2 THEN PRINT#2,CHRS(03);:PRINT HS(03);"[SPC]";
1110 AD=AD+NB
1120 GOTO 970
1130 CLOSE1:CLOSE2
1140 PRINT:PRINT
1150 PRINT "ASSEMBLY COMPLETE"
1160 END
1170 REM ** CONVERT HEX STRING TO H
1180 H=0:X=0
1190 IF HS="" THEN RETURN
1200 FOR X=1 TO LEN(HS)
1210 Y=ASC(MIDS(HS,X,1))
1220 IF Y<48 OR Y>70 THEN 1260
1230 IF Y>64 THEN Y=Y-7
1240 H=H*16+Y-48
1250 NEXT X
1260 X=X+1
1270 RETURN
1280 REM ** CONVERT DECIMAL H INTO HEX STRING
1290 H1=INT(H/256)
1300 H2=H-H1*256
1310 HS=HS(H1)+HS(H2)
1320 RETURN
1330 REM ** CONVERT ASCII STRING TO DECIMAL
1340 H=0
1350 IF HS="" THEN RETURN
1360 H=ASC(HS)
1370 RETURN
1380 REM ** DETERMINE ADDRESSING MODE AND EVALUATE ITS
OPERAND
1390 AM=2:ID=0:P=LEN(L3$)
1400 IF P=0 THEN AM=5:RETURN
1410 I1$=LEFT$(L3$,1)
1420 IF I1$="(" THEN 1510
1430 IF I1$="#" THEN 1660
1440 IF I1$="$" THEN 1800
1450 IF I1$="*" THEN 1760
1460 IF L3$="A" THEN AM=4:RETURN
1470 IF I1$>="0" AND I1$<="9" THEN 1840
1480 IF I1$>="A" AND I1$<="Z" THEN 1920
1490 AM=0
1500 RETURN
1510 ID=1
1520 I2$=L3$
1530 L3$=MIDS(L3$,2)
1540 I1$=LEFT$(L3$,1)
1550 P=LEN(L3$)
1560 GOSUB 1440
1570 I3$=L3$
1580 L3$=I2$
1590 IF LEFT$(I3$,1)<>")" THEN 1640
1600 I3$=MIDS(I3$,2)
1610 IF I3$="" THEN AM=12:RETURN
1620 IF I3$<>"," THEN AM=0:RETURN
1630 AM=7:RETURN
1640 IF I3$<>"," THEN AM=0:RETURN
1650 AM=6:RETURN
1660 I2$=L3$
1670 L3$=MIDS(L3$,2)
1680 I1$=LEFT$(L3$,1)
1690 P=LEN(L3$)
1700 GOSUB 1440
1710 L3$=I2$
1720 AM=1:RETURN
1730 L3$=MIDS(L3$,P+1)
1740 IF H>255 THEN HH=INT(H/256):H1=H-HH*256
1750 RETURN
1760 HS=MIDS(L3$,2)
1770 GOSUB 1340
1780 P=2
1790 GOTO 1730
1800 HS=MIDS(L3$,2):L3$=HS
1810 GOSUB 1180
1820 P=X
1830 GOTO 1730
1840 H=0
1850 FOR X=1 TO LEN(L3$)
1860 Y=ASC(MIDS(L3$,X,1))
1870 IF Y<48 OR Y>57 THEN 1900
1880 H=H*10+Y-48
1890 NEXT X
1900 P=X-1
1910 GOTO 1730
1920 FOR X=1 TO LEN(L3$)
1930 I3$=MIDS(L3$,X,1)
1940 IF (I3$<"A" OR I3$>"Z") AND (I3$<"0" OR I3$>"9")
THEN 1960
1950 NEXT X
1960 P=X-1
1970 I3$=LEFT$(L3$,P)
1980 IF NL=0 THEN 2030
1990 FOR X=1 TO NL
2000 IF I3$<L$(X) THEN NEXT X:GOTO 2030
2010 H=L$(X)+32768
2020 GOTO 1730
2030 H=AD:GOTO 1730
2040 AM=2:ID=0:ZP=0:P=0
2050 GOSUB 1390
2060 IF ID=1 THEN 2140
2070 IF AM=1 OR AM=4 OR AM=5 OR AM=12 THEN 2140
2080 IF L3$="" THEN AM=2:GOTO 2130
2090 IF LEFT$(L3$,1)<>" THEN 2990
2100 IF RIGHT$(L3$,1)="X" THEN AM=9:GOTO 2130
2110 IF RIGHT$(L3$,1)="Y" THEN AM=10:GOTO 2130
2120 GOTO 2990
2130 IF H<256 THEN ZP=1
2140 RETURN
2150 REM ** DETERMINE MACHINE CODE VERSION
2160 NB=0:OP=0:IN=0:A1=0
2170 IF L2$="" THEN RETURN
2180 IF L2$="*" THEN RETURN
2190 L2$=LEFT$(L2$,3)
2200 FOR X=1 TO 56
2210 IF L2$=IN$(X) THEN 2240
2220 NEXT X
2230 GOTO 2990
2240 IN=X:GOSUB 2040
2250 IF AM=2 AND OP$(IN,11)>-1 THEN AM=11:GOTO 2330
2260 IF AM=0 THEN 2990
2270 IF OP$(IN,AM)=-1 AND IN<>49 AND IN<>50 THEN 2990
2280 IF ZP=0 THEN 2330
2290 IF AM=2 THEN A1=3
2300 IF AM=9 THEN A1=8
2310 IF AM=10 THEN A1=13
2320 IF A1<0 AND OP$(IN,A1)>-1 THEN AM=A1
2330 O1=OP$(IN,AM):NB=NB$(AM):IF AM=11 THEN GOSUB 2370
2340 IF NB=2 THEN O2=H:O3=0
2350 IF NB=3 THEN O2=H1:O3=HH
2360 RETURN
2370 IF H>AD THEN H=H-AD-2:RETURN
2380 H=254-AD+H:RETURN
2390 INPUT#1,L1$,L2$,L3$,L4$
2400 RETURN
2410 REM ** TABLE OF 6502 INSTRUCTIONS AND HEX
EQUIVALENTS
2420 DATA ADC,69,6D,65,--,--,61,71,75,7D,79,--,--,
2430 DATA AND,29,2D,25,--,--,21,31,35,3D,39,--,--,
2440 DATA ASL,--,0E,06,0A,--,--,16,1E,--,--,
2450 DATA BCC,--,--,--,--,--,--,--,90,--,--,
2460 DATA BCS,--,--,--,--,--,--,--,B0,--,--,
2470 DATA BEQ,--,--,--,--,--,--,--,F0,--,--,
2480 DATA BIT,--,2C,24,--,--,--,--,--,
2490 DATA BMI,--,--,--,--,--,--,--,30,--,--,
2500 DATA BNE,--,--,--,--,--,--,--,D0,--,--,
2510 DATA BPL,--,--,--,--,--,--,--,10,--,--,
2520 DATA BRK,--,--,--,00,--,--,--,--,--,
2530 DATA BVC,--,--,--,--,--,--,--,50,--,--,
2540 DATA BVS,--,--,--,--,--,--,--,70,--,--,
2550 DATA CLC,--,--,--,18,--,--,--,--,--,
2560 DATA CLD,--,--,--,D8,--,--,--,--,--,
2570 DATA CLI,--,--,--,58,--,--,--,--,--,
2580 DATA CLV,--,--,--,B8,--,--,--,--,--,
2590 DATA CMP,C9,CD,C5,--,--,C1,D1,D5,DD,D9,--,--,
2600 DATA CPX,E0,EC,E4,--,--,--,--,--,
2610 DATA CPY,C0,CC,C4,--,--,--,--,--,
2620 DATA DEC,--,CE,C6,--,--,--,D6,DE,--,--,
2630 DATA DEX,--,--,--,CA,--,--,--,--,--,
2640 DATA DEY,--,--,--,88,--,--,--,--,--,
2650 DATA EOR,49,4D,45,--,--,41,51,55,5D,59,--,--,
2660 DATA INC,--,EE,E6,--,--,--,F6,FE,--,--,
2670 DATA INX,--,--,--,E8,--,--,--,--,--,
2680 DATA INY,--,--,--,C8,--,--,--,--,--,
2690 DATA JMP,--,4C,--,--,--,--,--,6C,--,--,
2700 DATA JSR,--,20,--,--,--,--,--,
2710 DATA LDA,A9,AD,A5,--,--,A1,B1,B5,BD,B9,--,--,
2720 DATA LDX,A2,AE,A6,--,--,--,--,BE,--,B6,
2730 DATA LDY,A0,AC,A4,--,--,--,B4,BC,--,--,
2740 DATA LSR,--,4E,46,4A,--,--,--,56,5E,--,--,
2750 DATA NOP,--,--,--,EA,--,--,--,--,--,
2760 DATA ORA,09,0D,05,--,--,01,11,15,1D,19,--,--,
2770 DATA PHA,--,--,--,48,--,--,--,--,--,
2780 DATA PHP,--,--,--,08,--,--,--,--,--,
2790 DATA PLA,--,--,--,68,--,--,--,--,--,
2800 DATA PLP,--,--,--,28,--,--,--,--,--,
2810 DATA ROL,--,2E,26,2A,--,--,--,36,3E,--,--,
2820 DATA ROR,--,6E,66,6A,--,--,--,76,7E,--,--,
2830 DATA RTI,--,--,--,40,--,--,--,--,--,
2840 DATA RTS,--,--,--,60,--,--,--,--,--,
2850 DATA SBC,E9,ED,E5,--,--,E1,F1,F5,FD,F9,--,--,
2860 DATA SEC,--,--,--,38,--,--,--,--,--,
2870 DATA SED,--,--,--,F8,--,--,--,--,--,
2880 DATA SEI,--,--,--,78,--,--,--,--,--,
2890 DATA STA,--,8D,85,--,--,81,91,95,9D,99,--,--,
2900 DATA STX,--,8E,86,--,--,--,--,BE,--,96,
2910 DATA STY,--,8C,84,--,--,--,94,--,--,--,
2920 DATA TAX,--,--,--,AA,--,--,--,--,--,
2930 DATA TAY,--,--,--,A8,--,--,--,--,--,
2940 DATA TSX,--,--,--,BA,--,--,--,--,--,
2950 DATA TXA,--,--,--,8A,--,--,--,--,--,
2960 DATA TXS,--,--,--,9A,--,--,--,--,--,
2970 DATA TYA,--,--,--,98,--,--,--,--,--,
2980 REM ** ERROR MESSAGE
2990 PRINT:PRINT:PRINT:PRINT "**** ERROR ****"
3000 PRINT L1$,L2$,L3$,L4$
3010 DCLOSE:CLOSE1:CLOSE2
3020 STOP
```

Listing 2. The Assembler program.

The '6809' centre

RECOMMENDED SYSTEMS...

| | EX VAT | INC VAT |
|--|--------|---------|
| STIRLING '77-68', 6809 Based Kit System, on 8" x 8" PCB's. | | |
| 6809 CPU BOARD; 1K RAM, 2K EPROM Socket (2716); RS-232 & TTL serial interface, 8 bit parallel I/O port, 77 way bus. VDU BOARD; 40 x 24 memory mapped, inverse characters, video output, 8 bit parallel keyboard input, 77 way bus. | 10.43 | 12.00 |
| CASSETTE BOARD; Kansas City CUTS standard, TTL levels, 300-2400 baud operation, 3.5" x 4.5" board. | 10.43 | 12.00 |
| 80 WAY EDGE CONNECTORS; one required per 8" board. | 5.22 | 6.00 |
| 78 WAY BACKPLANE; to take edge connectors. | 5.00 | 5.75 |
| 19" CARD FRAME; to hold backplane and boards. | 7.83 | 9.00 |
| SM-BUG; 2K Monitor EPROM, linking CPU with VDU & keyboard. | 43.04 | 49.50 |
| DESIGN NOTES; construction notes & diagrams for each board. | 20.00 | 23.00 |
| COMPLETE SYSTEM, CPU, VDU, CASSETTE. | 0.87 | 1.00 |
| | 109.56 | 126.00 |

(Excluding Power Supply, TV/Monitor, Keyboard & Components)
Full Range of 11 Boards Available, Including Disk Controller, Parallel Ports, Memory Boards, etc. Send for further details.

FUJITSU, FROM JAPAN.

| | | |
|--|---------|---------|
| MICRO-8, 6809 PROCESSOR & KEYBOARD. Twin '6809' processors, 64K RAM, 48k Colour Graphics RAM, Cassette, RS-232, Parallel Printer and Analogue Interfaces, RGB Colour and B & W Video output, 40 x 20 or 80 x 24 Screen, 32k ROM Basic, Numeric and Cursor control pad, Function Keys. | 868.70 | 999.00 |
| BMC RGB COLOUR MONITOR. 14" Screen, with TTL input levels. 8 pin connector supplied. | 260.00 | 299.00 |
| FUJITSU, DUAL 5 1/4" DRIVES. Single Density, Double Sided, with 656 Kbyte capacity. Supplied complete with adaptor for Micro-8. | 1216.52 | 1399.00 |
| COMPLETE SYSTEM, MICRO-8, MONITOR & DISKS. | 2345.22 | 2597.00 |

SOUTH WEST TECHNICAL PRODUCTS CORP - Superb Value from the USA.

| | | |
|---|---------|---------|
| SWTPC S/09-64K PROCESSOR. 6809 based CPU, with 64K RAM, expandable to 512K, with 2 Serial RS-232 & 1 Parallel Printer Port. Can be expanded to Multi-User system. Standard SS-50c bus. | 1347.83 | 1550.00 |
| SWTPC 8212 TERMINAL. 12" Intelligent Terminal, with full Keyboard & Cursor Pad. 82 x 20/24 Screen Format. Green Screen, Full Cursor Controls. | 860.87 | 990.00 |
| RS-232 Serial & Parallel Printer Interfaces, Selectable Baud Rate. | | |
| SWTPC D-5, TWIN 5 1/4" DISK DRIVES. Single Density, Double Sided Drives, 740 Kbyte Capacity. Supplied with Flex9 Operating System for S/09-64K. | 1129.57 | 1299.00 |
| COMPLETE SYSTEM, PROCESSOR, TERMINAL & DISKS. | 3338.27 | 3839.00 |

SOFTWARE - 6800 & 6809 - on Cassette - 300 Baud, CUTS, S1 Format.

| | | |
|---|-------|-------|
| 6800 Disassembler, with Move function. | 10.00 | 11.50 |
| 6800 Text Editor, with Source Listing. | 28.00 | 32.20 |
| 6800 Assembler, with Source Listing. | 28.00 | 32.50 |
| 6800 Text Processor, with Source Listing. | 28.00 | 32.50 |
| 6800 Relocator, with Source Listing. | 16.09 | 18.50 |
| 6800 8K Basic Interpreter (V2.3). | 15.22 | 17.50 |
| 6809 Text Editor, with Cassette Routines. | 60.78 | 69.90 |
| 6809 Macro Assembler, Memory to Cassette. | 60.78 | 69.90 |
| 6809 10.5K Basic Interpreter. | 60.78 | 69.90 |

FLEX9, 6809 Disk Software, on 5 1/4" or 8" Disks.

| | | |
|--|--------|--------|
| Configurable Flex, with Text Editor & Assembler | 120.00 | 138.00 |
| Sort/Merge Package, with File Editing Facilities | 58.26 | 67.00 |
| Debug Package, a complete 6809 Simulator | 58.26 | 67.00 |
| Disk Utilities, Additional Commands for FLEX | 46.96 | 54.00 |
| Text Processor, for Text Formatting | 58.26 | 67.00 |
| Text Editor & 6800/6809 Macro Assembler | 69.57 | 80.00 |
| Disk & Memory Diagnostics. Further FLEX Commands | 52.17 | 60.00 |
| Extended Basic, Advanced Business Basic for 6809 | 75.65 | 87.00 |
| Pascal, 6809 Machine Code Compiler | 145.22 | 167.00 |
| RMS, A Record Management System for 6809 | 145.22 | 167.00 |
| Tabula Rasa, Financial Reporting Package | 120.00 | 138.00 |
| Stylograph, The Complete Word-Processing Package | 173.04 | 199.00 |
| Micro-Modeller, Now Available for FLEX9 | 694.78 | 799.00 |

SHARP MZ-80A

477.39 549.00
Now in stock, the latest SHARP MZ-80A Personal Computer, 48K, Screen, Cassette & Sound.

APPLE SYSTEMS

Full Range of APPLE II Systems in Stock, together with a wide range of Business and Leisure Software.

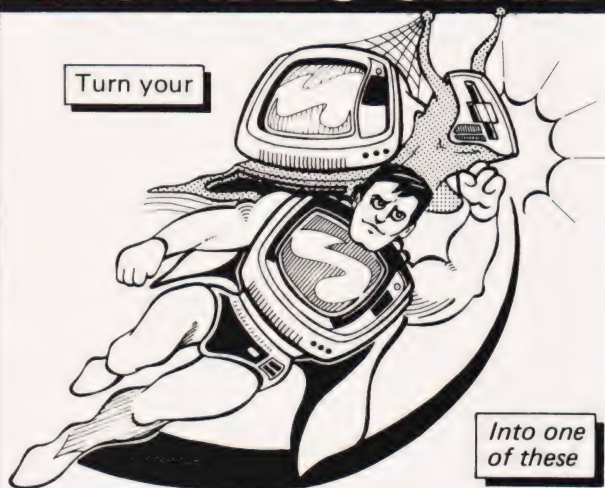
- Come and try any of our systems or make use of our mail order service.
 - All prices include carriage charges within the mainland UK.
 - All prices are correct at time of going to press and subject to availability.
 - Send for our latest price list and catalogue covering our vast range.
 - Further information is available on all the products listed, send for details.
 - Store opening hours - 9.30 to 5.30 - Monday to Saturday - Access & Visa.
- STIRLING MICROSYSTEMS LTD - THE '6809' HARDWARE & SOFTWARE STORE

STIRLING MICROSYSTEMS

241 Baker Street, London NW1 6XE. Telephone: 01-486 7671.

TRS80 Models I+III and VIDEO GENIE

Turn your



Into one
of these

Announcing ACCEL3 - the practical BASIC compiler for home, education, or business.

Are you troubled by gradual graphics, languid loops, tedious table searches, or capricious keyboard response? ACCEL3 is the cure. Highly compatible with interpreted BASIC - correct programs compile without modification.

On Tape or Disk

£49.95

southern
software

PO Box 39, Eastleigh, Hants, SO5 5WQ

BBC MICRO GAMES

TWO SUPERB GAMES CASSETTES AVAILABLE
NOW FOR THE BBC MICRO (MODELS A AND B)
DEMONSTRATING ITS FANTASTIC COLOUR
GRAPHICS AND SOUND.

CASSETTE ONE:- (1) STAR TREK - The classic computer game. A superb version with 8x8 Galaxy, Klingons, Phasers, etc.

(2) CANDY FLOSS - A tremendous new game in which you test your business skills running a candy floss stall on Blackpool's Golden Mile, but watch the weather and the donkeys!

- ONLY £5.95 inc

CASSETTE TWO: An exciting collection of games with music and graphics to keep the family amused for hours:- HANGMAN, KRYPTOGRAM, DICE, BEETLE, GRAND NATIONAL AND MUSIC.

- ONLY £3.95 inc

CASSETTE THREE: For the arcade fanatics:- MUTANT INVASION - a brilliant new "SPACE INVADERS" type game. WARNING!!! very addictive.

- ONLY £5.95 inc

CASSETTE FOUR: BREAKOUT. Terrific version of the popular arcade game, six skill levels, 1 or 2 players.

- ONLY £3.95 inc

All games are in full colour and sound, and will run on both Model A and Model B micros.

Deduct £1 for 2 cassettes and £2 for 3 or more cassettes.
Send cheque/P.O. to:

Sinclair, Dept C.T., 55 Fitzroy Road, Bispham,
Blackpool, Lancs.

CROYDON COMPUTER CENTRE



29a, Brigstock Road,
Thornton Heath, Surrey,
CR4 7JJ.
ENGLAND.
Telephone
01-689 1280.



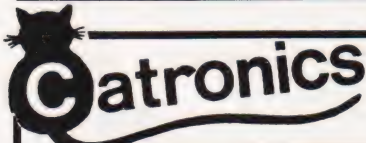
- ★ For all your computing requirements delivery from stock.
- ★ Retail, mail order and hire.
- ★ New VIDEO GENIE I and II only £295.
- ★ Commodore VIC only £169.
- ★ 32K PET only £625
- ★ 32K 80 column PET only £895
- ★ Transtec 1200 monitor only £99
- ★ Seikosha GP 100 printer only £199.
- ★ Super reliable OKI microline 80 only £295.
- ★ Special offers this month.
- ★ 1. Ex-demo Commodore 4040 disk drive only £500.
- ★ 2. Clip this ad and send with your order or bring it into the shop for £5 off these prices.

All prices exclusive of V.A.T.

We endeavour to maintain lowest possible prices for ribbons, paper and software.

T.A.Bs. Dealers.

01-689 1280.



— the South East England Specialists in Everything for the New Computer Age.

video genie system

New model with extended BASIC

- AUTO RENUMBER
- UPPER AND LOWER CASE
- BUILT-IN SOUND BOX
- UHF MODULATOR
- INTERNAL CASSETTE
- 2nd CASSETTE INTERFACE

GENIE I



CATRONICS
PRICE **£297** + VAT

- ★ EXPANSION BOX
- ★ PRINTER
- ★ DISK DRIVE
- ★ 100's OF PROGRAMS
- ★ TRS-80 LEVEL II
- ★ SOFTWARE COMPATIBLE

AS
EXTRA
OPTIONS

If you cannot call, write for FREE illustrated leaflet

SPECIAL COMPUTER-RTTY PACKAGE for TRS-80 and VIDEO GENIE

Catronics wonderful new CT600 RTTY package enables a TRS-80 (16K, level 11) or Video Genie computer to send and receive Radio Teletypewriter Messages. The package includes a pcb module and program cassette. The pcb carries the terminal unit which includes a PLL discriminator for reception and can handle wide shift as well as narrow. Also on the pcb is an audio oscillator which plugs into the microphone socket of your SSB or FM transmitter to produce FSK or AFSK transmission. The Transmit/receive relay on the pcb is keyboard controlled, as are all other functions. The software allows operation on 4 speeds - 45,50,75 and 110 bands. Text transmission is simplified with automatic letters/figures shift and there is provision for 10 memories, which can be stored on cassette. Transmit text (including memories) is displayed and entered into buffer, even whilst receiving.

Send now for complete details!

C.T. 600 complete package: £106. + VAT + £1.50 p&p (= £123.40)

SPECIAL PACKAGE DEAL Video Genie Computer + CT 600 for only £465 incl. VAT COMING SOON! New disk version and a printer support version.

CREDIT TERMS available. Pay by Access, Barclaycard or Catronics Creditcharge Card. Goods may also be ordered via PRESTEL: use MAILBOX account 016696701 Personal Shoppers Welcome. 3 Big Car Parks within 100 yds



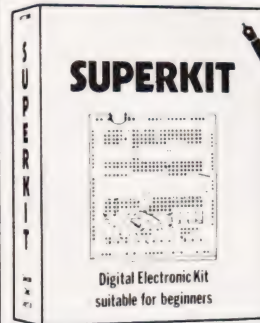
CATRONICS LTD (Dept.296),
COMMUNICATIONS HOUSE,
20 WALLINGTON SQUARE,
WALLINGTON, SURREY SM6 8RG.

Tel. 01-669 6700(9am to 5.30pm. Sat 12.45pm) Closed lunch 12.45-1.45

CAMBRIDGE LEARNING

SELF-INSTRUCTION COURSES

A PRACTICAL DIGITAL ELECTRONIC KIT FOR ★ LESS THAN £20 ★



SUITABLE FOR BEGINNERS

NO SOLDERING!

Learn the wonders of digital electronics and see how quickly you are designing your own circuits. The kit contains: seven LS TTL integrated circuits, breadboard, LEDs, and all the

DIL switches, resistors, capacitors, and other components to build interesting digital circuits; plus a very clear and thoroughly tested instruction manual (also available separately). All this comes in a pocket size plastic wallet for only £19-90p inc VAT and p&p. This course is for true beginners:

- needs no soldering iron.
- asks plenty of questions, but never leaves you stuck and helpless.
- teaches you about fault-finding, improvisation, and subsystem checking.
- the only extra you need is a 4!V battery Ever Ready 1289, or similar, or a stabilised 5V power supply.

Using the same breadboard you may construct literally millions of different circuits.

This course teaches boolean logic, gating, R-S and J-K flipflops, shift registers, ripple counters, and half-adders. Look out for our supplementary kits which will demonstrate advanced arithmetic circuits, opto-electronics, 7-segment displays etc.

It is supported by our theory course

DIGITAL COMPUTER LOGIC AND ELECTRONICS ~~£8.50~~ £6.00 for beginners, and our latest, more advanced text;

DIGITAL DESIGN £7.00

Please send for full details (see coupon below).

GUARANTEE No risk to you. If you are not completely satisfied, your money will be refunded ~~specimens~~ ~~returned~~ ~~in~~ ~~good~~ ~~condition~~ ~~within~~ ~~28~~ ~~days~~ ~~of~~ ~~receipt~~.

CAMBRIDGE LEARNING LIMITED, UNIT 56 RIVERMILL SITE, FREEPOST, ST IVES, CAMBS, PE17 4BR, ENGLAND. TELEPHONE: ST IVES (0480) 67426. FAX No: 11465

All prices include worldwide postage (airmail is extra - please ask for prepayment invoice). Giro Acc No 2789158.

Please allow 28 days for delivery in UK

Please send me:

.....SUPERKIT(S) @ £19.90

.....Free details of your other self-instruction courses.

I enclose a *cheque/PO payable to Cambridge Learning Ltd for £..... (*delete where applicable)

Please charge my:

*Access / American Express / Barclaycard / Diners Club Eurocard / Visa / Mastercard / Trustcard

Expiry Date..... Credit Card No

Signature.....

Telephone orders from card holders accepted on 0480 67446 Overseas customers (including Eire) should send a bank draft in sterling drawn on a London bank, or quote credit card number.

Name.....

Address.....

Cambridge Learning Limited, Unit 56, Rivermill Site, FREEPOST, St Ives, Huntingdon, Cambs, PE17 4BR, England. (Registered in England No 1328762).



TANGERINE

APPROVED SOFTWARE FOR

MICROTAN

MICRO TANTEL SOFTWARE

MICRO TANTEL IS A SOFTWARE PACKAGE WHICH INTERFACES TO TANTEL UNITS AND YOUR COMPUTER. THE MOMENT YOU CONNECT YOUR COMPUTER TO THE TANTEL UNIT YOU GET FULL COLOUR FACILITIES WITH A SCREEN SIZE OF 24x40. FETCH AND SAVE PRESTEL PAGES INTO USER RAM AREA.
UPDATE AND DISPLAY PAGES IN ANY ORDER AND AT ANYTIME.
EPROM **£19.95**

MICROTAN COMPANION BOOK 2ND EDITION

- * DISCOVER THE INSIDE WORKINGS OF MICROTAN BASIC
- * PAGE ZERO POINTERS INTO BASIC
- * NOW LOAD MORE THAN ONE PROGRAM INTO STORE AT ANY TIME
- * CREATE AND ADD YOUR OWN COMMANDS
- * DISPLAY THE REGISTERS WHILST YOUR PROGRAM IS RUNNING
- * IMPROVE DATA RESTORE ROUTINE
- * FULL VDU MEMORY MAP WITH HEX PLUS DECIMAL VALUES PLUS FULL GRAPHICS CHARACTER CHART AND LOTS MORE **£9.95**

HIGH RESOLUTION GRAPHICS SOFTWARE

THIS SOFTWARE PACKAGE WILL ENABLE YOU TO USE THE NEW FACILITIES OF THE TANGERINE HIGH RESOLUTION GRAPHICS BOARD. THE PACKAGE CONSISTS OF 38 NEW COMMANDS WITHIN BASIC WHICH WILL ENABLE YOU TO USE THE NEW BOARD WITH EASE. NOW MIX CHUNKY GRAPHICS WITH HIGH RES AND ALPHA.

EPROM **£16.95**

MICROTANIC SOFTWARE PRODUCT LIST

GAMES TAPES

| | | | | |
|-----------------|---|------|-----|------|
| ADVENTURE 1 | — | 7K | M/C | 5.95 |
| ADVENTURE 2 | — | 7K | BAS | 6.95 |
| ADVENTURE 3 | — | 16K | M/C | 9.95 |
| ADVENTURE 4 | — | 16K | BAS | 9.95 |
| THE DEFENDER | — | 7K | M/C | 6.95 |
| TANK RAID | — | 16K | M/C | 9.95 |
| EARTH ATTACK | — | 7K | M/C | 6.95 |
| SPACE INVADERS | — | 3K | M/C | 5.95 |
| THE GOBLER | — | 6K | M/C | 6.95 |
| SUB STRIKE | — | 5K | BAS | 6.95 |
| STAR CHESS | — | 3K | M/C | 6.95 |
| 3D MAZE | — | 7K | BAS | 6.95 |
| 3D OXO | — | 7K | BAS | 6.95 |
| GRAPHIC PUZZLES | — | 7K | M/C | 6.95 |
| MOLE SWAT | — | 7K | BAS | 6.95 |
| GAMES PACK 1 | — | 3x7K | BAS | 8.95 |
| GAMES PACK 2 | — | 3x7K | BAS | 8.95 |
| GAMES PACK 3 | — | 3x7K | BAS | 8.95 |
| GAMES PACK 4 | — | 4x7K | M/C | 8.95 |

SOFTWARE — FIRMWARE

| | | | |
|---|-----|-------|-------|
| TOOLKIT 1 | 2K | EPROM | 22.50 |
| MICROTANTEL | 2K | EPROM | 19.95 |
| HI RES TOOLKIT | 2K | EPROM | 16.95 |
| FORTH LANGUAGE | IN | EPROM | 34.95 |
| 2 PASS ASSEMBLER | | EPROM | 34.95 |
| TOOLKIT 2 | 2K | EPROM | 19.95 |
| WORD PROCESSOR | IN | EPROM | 39.95 |
| FILE UTILITIES | BAS | TAPE | 9.95 |
| M/C RELOCATOR | M/C | TAPE | 5.95 |
| EPROM PROGRAMMER SELF BUILD | | | 9.95 |
| TEXT PROCESSOR | M/C | TAPE | 19.95 |
| BAS LINKED ASSEMBLER | | TAPE | 7.95 |
| MORSE CODE GENERATOR | | TAPE | 4.95 |
| Q.T.H. LOCATOR | | TAPE | 4.95 |
| MATHS PACK | BAS | TAPE | 6.95 |
| SINCLAIR PRINTER INTERFACE | | | 29.95 |
| EPROM PROGRAMMER — PLUGS INTO THE SYSTEM RACK — WILL PROGRAM 2716's, 2732's, 2516's, 2532 | | | 69.95 |

TOOLKIT

APPEND LOAD TWO PROGRAMS INTO STORE NOW
HEX CONVERSION FOR THOSE POKES
PLOT COMMANDS FOR GRAPHICS
SINGLE KEY COMMANDS
FIND AND DISPLAY LINE NOS OF ANY VARIABLE
AUTO NUMBERING NO MORE TYPING IN OF LINE NUMBERS
RENUMBER RESOLVES ALL GOTO'S, GOSUB'S, THEN'S, ETC.
EPROM **£22.50**

2 PASS ASSEMBLER

AVAILABLE IN 2732 EPROM FOR INSERTION INTO J2 ON TANEX OR OUR 8K EPROM EXTENSION BOARD.
* FULL SOURCE CODE EDITING FACILITIES.
* CASSETTE ROUTINES FOR SAVING CODE.
* ASSEMBLY FROM SOURCE CODE HELD IN STORE OR ON TAPE.
* ALL STANDARD 6502 OP CODES + LABELS OF UP TO 6 CHARACTERS.
* HEX, DECIMAL AND CHARACTER CONSTANTS SUPPORTED.
* ASSEMBLY — LABEL — LIST — PRINT
* RELOCATABLE ASSEMBLY FOR EPROMS.
FULL DOCUMENTATION **£34.95**

ADVENTURES NOW AVAILABLE FOR MICROTAN

SEND CHEQUE POSTAL ORDER PLUS 60p POST AND PACKING TO:

MICROTANIC SOFTWARE

235 FRIERN ROAD
DULWICH, LONDON OBD
Or tel 01-693 7659
PRICES INCLUDE VAT

A VOTING LOADER

Rod Humphreys

Increasing the speed of tape-based operations tends to increase the chances of data errors. This utility removes virtually all these problems by taking a vote on the reliability of the information it has read.

It was when my second backup copy of FORTH announced loading errors that I realised something had to be done. There I was, surrounded by loaders and tape recorders with four different Baud rates and none of it was any use. The trouble with my existing loading techniques was that they would only detect loading errors. What I needed was a loader that would detect the errors, but still load the program correctly.

The State Of Play

Let us review the present situation:

1) Most problems arise when loading machine code. A properly designed loader for a high level language like BASIC will carry on loading in spite of errors. Any error which may have occurred will usually be obvious and therefore possible (I don't mean easy) to correct. (My idea of a properly designed loader may not be the same as the people who wrote your software.)

2) The fastest and most straightforward way of saving a program is simply to transfer whole bytes from memory in sequence at the highest Baud rate your equipment will support.

3) If the hardware is correct there does not seem to be a greater error rate at the higher Baud rates.

4) Difficulties experienced in loading other people's tapes are usually due to incompatibility in tape recorders. The problem is not usually one of tape speed but of azimuth setting. It is best resolved by attempting to load only one track from a good quality stereo recorder. Problems encountered when loading one's own tapes are more likely to be due to tape dropout or electrical noise on the main supply.

To detect a loading error in a machine code program, the most common technique employed is that of 'checksum' — as each group of n bytes of code is sent to tape it is added into a register. The total may be the actual sum or just the re-

mainder, depending on how many registers are used. This total is then sent out after the last item in the group. The number n can be a constant, say 256, or may be sent out to tape immediately after the address of that particular group. When the program is loaded, the incoming bytes are again added and then compared with the correct total which follows.

This type of loader proves to be quite good at detecting errors. On occasion, two compensating errors may pass undetected but this is rare. The chief disadvantage is that, if several errors do occur, it doesn't usually help matters to try again.

In order to reduce errors, several methods are employed. The most usual is to recommend saving backup copies at 300 Baud. The occasional lunatic will sometimes recommend a paper tape punch at 110 Baud. I admit this actually works, but I couldn't live with it!

Another technique is to adopt something like HEX DUMP. This is a method whereby each byte is divided into two four-bit Hex numbers, then converted to the equivalent ASCII code and sent to tape followed by a CR (Carriage Return). One can only assume that by taking three times as long it is exposed to three times the risk of dropout error.

It is my considered opinion that such methods are only of value when they help to compensate for hardware that is less than satisfactory (That should attract some flak!).

If we are to take three times the minimum loading time then we can make better use of this sacrifice.

The Casting Vote

One way to ensure that a program had loaded correctly would be to load two versions of the same program and then compare them to see if they are identical. Better than this would be to load three versions and allow them to 'vote' on which is the correct value for each location. This last method forms the basis of the voting loader described here.

The program is written for the 6502 microprocessor and uses some simple routines available in the CEGMON monitor; these are not

essential and may be either written in code, obtained from your own monitor or left out. The source code consists of two routines, one for save and one for load. The program saves and loads whole pages; by pages, we mean sections of memory of 256 bytes. When using Hex notation, this refers to the first two digits of an address thus the address \$IE34 refers to an address in page \$IE.

SAVE The starting page is specified together with the number of pages to be saved. Each page is sent out to tape three times in succession followed by a set number of nulls.

LOAD The starting page is specified. This means that a program can be loaded anywhere in memory, regardless of the address from which it was saved. The first three pages are loaded directly into memory starting at the page specified. During the nulls which follow, the three pages are compared. If at least two or three locations agree, then that value is placed in the lower page. If all three address locations are different then the address together with the three alternatives are printed on the screen. When the comparison of the three pages is complete, the number of voting decisions made is displayed on the screen. Thus a normal load is accompanied by 00 for each page loaded. If the display includes any other number such as 03 then loading errors have occurred but the program is still correct.

Program Notes

This method of loading requires that at least two pages of memory must be available above the finished program. The printing on screen of errors is useful but not strictly necessary. Providing that a tally of voting errors is kept somewhere in memory, there need be no printing on the screen.

The number of nulls used in the program (line 490) is satisfactory at 4800 Baud. It may be reduced if the loader is normally used at lower speeds or if printing on the screen does not occur between pages. The program was developed on a UK101 computer, although this is only relevant to the availability of zero page

locations, the screen address and the ACIA address. There seems no reason to suppose that the program could not be adapted for use on any system.

It is also possible to calculate the probability of a successful load of one page. This depends on the number of errors encountered; the chance of two coinciding errors becomes rapidly greater as the error rate increases. The graph (Fig. 1) shows the probability of success plotted against the average number of errors in each 256 bytes. It can be seen that there is only a one in five chance of failure with as many as four errors in each page loaded.

It may occur to you that there is a possibility that the starting symbol may be corrupted thus preventing

the load of a page. You are correct. This cannot be entirely avoided but is minimised by the method adopted. The actual probability is 1/769. Consider as a contrast the probability of corruption in many conventional loaders, where the start address, number of bytes and actual checksum are *all* at risk. You will realise if you think along these lines that it is best to maintain a good ratio of start byte to total bytes, and the page seems to be a suitable compromise.

The Voting Loader has been in regular use, by myself and friends, for eight months. In practice it has been of even more value than indicated by initial tests. It copes particularly well with low error rates (with an error rate greater than 10

there is a tendency to lose control of the situation entirely). The loader seems to perform in accordance with the graph shown, with the additional bonus that most errors encountered in practice are of low frequency. Permanent errors due to tape dropout and other temporary effects due to electrical noise (or even low volume control setting) have also been successfully overcome.

Notwithstanding my earlier comments, it has also proved invaluable in loading other people's tapes. In fact nowadays I tend to regard a loading error with tolerance and understanding. After all, one cannot expect perfect tapes, can one? Oh incidentally, on the whole, it might be best to put it in EPROM.

```

ACIA1=$F000      Status Register of ACIA
ACIA2=$F001      Data Register of ACIA

*** Monitor Subroutines Used ***

MSTART=$F97E     Monitor entry
SPACE=$FB6E     Print space on display
CRLF=$FBF5      Print CR LF
PRINT1=$FE8D    Prints data byte in $FC
PRINT2=$FEAC    Print address in $FE/$FF,
                space, value in $FC
                displayed
SCNCLR=$FE59    Clears screen

*** SAVE ROUTINE ***

To save a program put first page in $F7, number
of pages in $F8. Enter program at $1F03.

1F00 4C 50 1F    JMP LOAD
1F03 A5 F7      SAVE   LDA $F7      Transfer 1st
1F05 85 FA      STA $FA      page number
1F07 A9 00      LDA #0
1F09 A8         TAY
1F0A 85 F9      STA $F9
1F0C A9 DB      NEXB   LDA #$DB     Graphic cross
1F0E 8D 29 D1   STA $D129   Store on scrn
1F11 20 43 1F   JSR TAPOUT
1F14 A9 03      LDA #3      Send 3 copies
1F16 85 FB      STA $FB
1F18 B1 F9      LOO2   LDA ($F9),Y
1F1A 20 3C 1F   JSR OUT1    Send a byte
1F1D C8         INY
1F1E D0 F8      BNE LOO2    Loop for 256
1F20 C6 FB      DEC $FB     Second copy
1F22 D0 F4      BNE LOO2
1F24 A0 C0      LDY #C0     Send nulls,
1F26 A9 00      LDA #0      adjust to
1F28 20 3C 1F   LOO3   JSR OUT1    suit baud
1F2B C8         INY          rate
1F2C D0 FA      BNE LOO3
1F2E E6 FA      INC $FA
1F30 C6 F8      DEC $F8     Another page
1F32 D0 D8      BNE NEXB   Last one?
1F34 A9 E2      LDA #$E2   Done, send
1F36 20 43 1F   JSR TAPOUT of load
1F39 4C 7E F9   JMP MSTART Exit
1F3C 8D A9 D1   OUT1   STA $D1A9 Screen shows
1F3F 20 43 1F   JSR TAPOUT save progress
1F42 60         RTS
1F43 48         PHA          Save byte
1F44 AD 00 F0   TEST1  LDA ACIA1  Check ACIA,
1F47 4A         LSR A      is bit 1 set?
1F48 4A         LSR A
1F49 90 F9     BCC TEST1 Keep looking
1F4B 68         PLA          Get next byte
1F4C 8D 01 F0   STA ACIA2 and send it
1F4F 60         RTS

*** LOAD ROUTINE ***

To load a program put first page in $F7. Enter
program at $1F00.

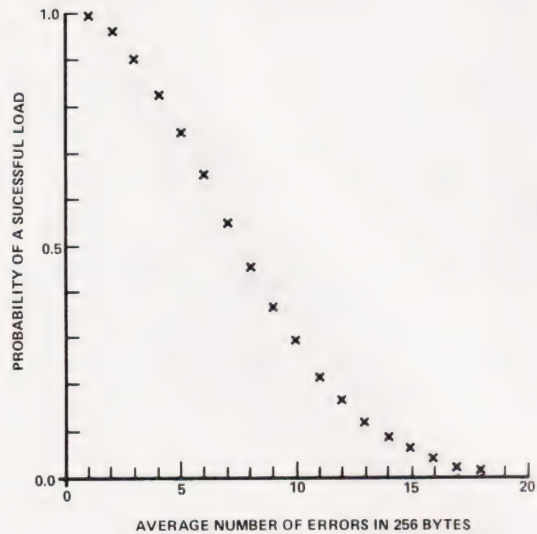
1F50 20 59 FE   LOAD   JSR SCNCLR  Clear screen
1F53 A5 F7     LDA $F7
1F55 85 FA     STA $FA
1F57 A9 00     NPAGE  LDA #0
1F59 AA       TAX
1F5A 85 F9     STA $F9
1F5C A8       TAY
1F5D 20 DF 1F  IDENT  JSR IN1     Get byte
1F60 C9 E2     CMP #E2     End of load?
1F62 D0 03     BNE NEWB   No so branch
1F64 4C 7E F9  JMP MSTART Exit
1F67 C9 DB     NEWB   CMP #$DB   Start of
1F69 D0 F2     BNE IDENT  block?
1F6B A9 03     LDA #3     3 copies
1F6D 85 F8     STA $F8
1F6F 20 EC 1F  LOO4   JSR IN2     Get next byte
1F72 91 F9     STA ($F9),Y Store it
1F74 C8       INY
1F75 D0 F8     BNE LOO4   Loop for 256
1F77 E6 FA     INC $FA
1F79 C6 F8     DEC $F8
1F7B D0 F2     BNE LOO4   Done 3?
1F7D C6 FA     DEC $FA
1F7F B1 F9     LOO5   LDA ($F9),Y
1F81 85 E3     STA $E3     Load one byte
1F83 C6 FA     DEC $FA     from each
1F85 B1 F9     LDA ($F9),Y page.
1F87 85 E2     STA $E2
1F89 C6 FA     DEC $FA
1F8B B1 F9     LDA ($F9),Y
1F8D 85 E1     STA $E1
1F8F C5 E2     CMP $E2     Compare 1,2
1F91 D0 18     BNE ERROR1 Equal?
1F93 C5 E3     CMP $E3     Compare 1,3
1F95 F0 01     BEQ NORMAL All OK
1F97 E8       RECERR  INX          Error count
1F98 E6 FA     NORMAL  INC $FA     Adjust to 3rd
1F9A E6 FA     INC $FA     page address
1F9C C8       INY
1F9D D0 E0     BNE LOO5   Done 256?
1F9F 20 F5 FB  JSR CRLF   Output the
1FA2 86 FC     STX $FC     number of
1FA4 20 BD FE  JSR PRINT1 errors
1FA7 C6 FA     DEC $FA     Set next
1FA9 D0 AC     BNE NPAGE  block addr
1FAB C5 E3     CMP $E3     Compare 1,3
1FAD F0 E8     BEQ RECERR OK?
1FAF 85 FC     STA $FC     Save 1
1FB1 A5 E2     LDA $E2
1FB3 C5 E3     CMP $E3     Compare 1,3
1FB5 D0 05     BNE ERROR2 OK?
1FB7 91 F9     STA ($F9),Y Save correct
1FB9 4C 97 1F  JMP RECERR value

```

A VOTING LOADER

```

1FBC 20 F5 FB      ERROR2 JSR CRLF      None agree
1FBF 84 FE          STY $FE      Display addr
1FC1 A5 FA          LDA $FA      and the three
1FC3 85 FF          STA $FF      alternatives
1FC5 20 AC FE      JSR PRINT2
1FC8 20 E6 FB      JSR SPACE
1FCB A5 E2          LDA $E2
1FCD 85 FC          STA $FC
1FCF 20 BD FE      JSR PRINT1
1FD2 20 E6 FB      JSR SPACE
1FD5 A5 E3          LDA $E3
1FD7 85 FC          STA $FC
1FD9 20 BD FE      JSR PRINT1
1FDC 4C 97 1F      JMP RECERR
1FDF AD 00 F0      IN1  LDA ACIA1      Check ACIA, is
1FE2 4A            LSR A          register full
1FE3 90 FA          BCC IN1        Keep looking
1FE5 AD 01 F0      LDA ACIA2      Get next byte
1FE8 8D 29 D1      STA $D129      Store on scrn
1FEB 60            RTS
1FEC AD 00 F0      IN2  LDA ACIA1
1FEF 4A            LSR A
1FF0 90 FA          BCC IN2
1FF2 AD 01 F0      LDA ACIA2
1FF5 8D A9 D1      STA $D1A9
1FF8 60            RTS          Screen shows
                                     load progress
    
```



The program shown above, whilst not guaranteeing success at every attempt, should significantly decrease your loading errors — especially at high speeds.

Fig. 1. This graph shows the performance of the Voting Loader. As can be seen, even if you have up to four errors in any one page (256 bytes) you still stand a very good chance of getting a successful load.

Complete Sinclair ZX81 BASIC Course

At last, a comprehensive text for your Sinclair ZX81! The complete BASIC Course is a manual which will immediately become an indispensable work of reference for all your ZX81 programming.

Whether you have never done any programming or whether you are an experienced microcomputer user, the Complete BASIC Course will provide an invaluable aid.

Not Only 30 Programs for the Sinclair ZX81: 1K —

Not only over 30 programs, from arcade games to the final challenging Draughts playing program, which all fit into the unexpanded 1K Sinclair ZX81 but also notes on how these programs were written and special tips! Great value!

Machine Language Programming Made Simple for the Sinclair —

A complete beginner's guide to the computer's own language — Z80 machine language. Machine language programs enable you to save on memory and typically give you programs that run 10-30 times faster than BASIC programs.

ZX81 ROM Disassembly Part A

This book is for the programmer that needs complete answers about the ZX81. Dr Logan has examined all routines in the ROM and here he comments on each one. It covers all ROM locations from 0000H to 0F54H, and includes all functions except for the routines used in the floating point calculator.

Understanding Your ZX81 ROM

A brilliant guide for more experienced programmers by Dr. Ian Logan, this book illustrates the Sinclair's own operating system and how you can use it.

SPECIAL OFFER!
FREE BLANK CASSETTE
WITH EVERY BOOK

OFFER EXTENDED TO 30 JUNE 1982

The Essential Software Company

We are pleased to announce the opening of our new shop at the TECHNICAL LEISURE CENTRE, 1, GRANGWAY, KILBURN, LONDON, NW6.

GRAND OPENING -
29th 30th &
31st MAY.

NEWS



OUR GREAT
NEW
CATALOGUE
IS NOW
AVAILABLE

SEND S.A.E.

Order Form:

Orders to
The Essential Software Company, Dept BT
(Visconti Ltd.) O1 866 5445
47 Brunswick Centre, London WC1N 1AF

NAME:

ADDRESS:

Postcode



- | | |
|---|---------------------------------|
| The Complete Sinclair ZX 81 BASIC Course Basic Course | £17.50 <input type="checkbox"/> |
| Programs on Cassette | £ 2.50 <input type="checkbox"/> |
| Sinclair ZX 81 ROM Disassembly Part A - 0000H-0F54H | £ 7.00 <input type="checkbox"/> |
| Not Only 30 Programs/Sinclair ZX 81:1K | £ 6.95 <input type="checkbox"/> |
| Machine Language | |
| Programming Made Simple | £ 8.95 <input type="checkbox"/> |
| Understanding Your ZX 81 ROM | £ 8.95 <input type="checkbox"/> |
| Postage and Packing | £ 0.70 <input type="checkbox"/> |
| Remittance enclosed | |

Come and see our exciting range for ZX81, TRS80 VIDEO GENIE

MicroValue

MONEY SAVERS

MicroValue Exclusive with the exclusive **MicroValue 12 Months Warranty***

Software for the Gemini Multiboard System

COMAL 80—The extended BASIC with powerful PASCAL structures at **£100**

GEM PEN—A comprehensive text editor and text formatting package at **£45**

GEM ZAP—A very fast Z80 assembler with comprehensive screen editing at **£45**

ALL THE ABOVE AVAILABLE ON CASSETTE OR DISC.

MicroValue Exclusive

MicroValue's 'Nascom Special'

SAVE OVER £65

We've put together a microcomputer kit containing the Nascom 2, Nas-Sys 3, Graphics ROM, Bits & P.C.'s programmers aid, Gemini 3A PSU, 16K RAM Board and mini motherboard. The result is a powerful micro using market proven boards and components.

RRP OVER £405 + VAT

MicroValue Exclusive

SHARP MZ80K with Super Graphics

SAVE £200!

The 48K RAM System is offered at a rock bottom price with the Quantum Micros Hi Res Graphics which gives resolution down to a single dot and high res. plotting. Characters are user definable and the pixel characters actually join. Five free games packages are included too!

RRP £645 + VAT

MicroValue price

£445 + VAT



48K MZ 80K

RRP £460 + VAT

MicroValue price **£345** + VAT



£20 worth of accessories **FREE** with every **Epson Printer**

MicroValue price

| | |
|---------------------|------------|
| Epson MX80T | £359 + VAT |
| Epson MX80FT1 | £399 + VAT |
| Epson MX80FT2 | £465 + VAT |
| Epson MX100..... | £575 + VAT |

Buy one of the above Epsoms from MicroValue and we'll give you a Pack of Fanfold paper, Interfacing Document and Connecting Cord for Multiboard or Nascom. The accessories are worth £20 but you can have them absolutely FREE.



Cheapest Printer in the UK!

Nascom IMP + Graphics Only £199 + VAT

SAVE £156

MicroValue has slashed the price of the 80cps, 80 column IMP dot matrix printer. And added Imprint's high res. graphics and double width character option. IMP has bi-directional printing and friction/tractor feed.

RRP £355 + VAT
MicroValue price **£199 + VAT**

NASBUS Compatible DOUBLE DENSITY Disk System - Available Ex Stock

With hundreds in daily use the Gemini Disk system is now the standard for Nascom and Gemini Multiboard systems. Single or twin drive configurations are available, giving 350K storage per drive. The CP/M 2.2 package available supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers, and auto single-double density selection. An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 2 it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

Single drive system

(G809, G815/1)

£450 + VAT

Double drive system

(G809, G815/2)

£675 + VAT

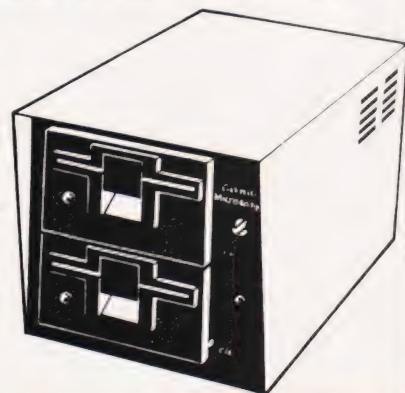
CP/M 2.2 package

(G513)

£100 + VAT

Polydos 2

£90 + VAT



GEMINI GALAXY

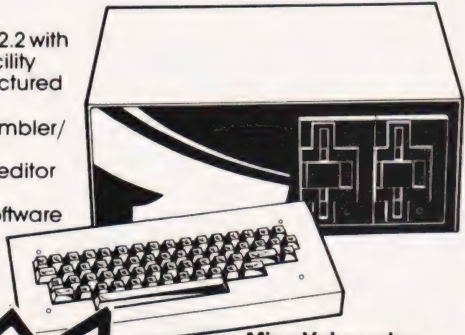
A new CP/M system based on Multiboard

HARDWARE

- * Twin Z80A CP/M System
- * 64K Dynamic RAM
- * 800K Disk Storage (Formatted)
- * 80 x 25 Screen Format
- * Inverse Video
- * Prog. Character Generator
- * 160 x 75 Pixel Graphics
- * Centronics Parallel I/O
- * RS232 I/O
- * Light pen interface
- * 59-Key ASCII Keyboard

SOFTWARE

- * Full 64K CP/M 2.2 with screen edit facility
- * Comal-80 structured BASIC
- * GEM-ZAP Assembler/Editor
- * GEM-PEN Text editor
- * GEM-DE BUG debugging software



MicroValue Exclusive

MicroValue price
£1,450
+ VAT

80 x 25 Video for Nascom

Nascom owners can now have a professional 80 x 25 Video display by using the Gemini G812 Intelligent Video Card with onboard Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Built and tested.

MicroValue Exclusive

£140 + VAT

New Software for Nascom Systems

- POLYDOS 1** A disk operating system for use with Nascom 1 or 2 and Gemini G805 Disk Systems. An incomparable and extremely well presented DOS that includes an editor and assembler and adds disk commands to the Nascom BASIC. MicroValue price **£90 + VAT**
- MATHSPAK** Double precision maths package on tape. MicroValue price **£13 + VAT**
- MATHSPAK Handler** Used in conjunction with MATHSPAK. MicroValue price **£9.95 + VAT**
- Command Extender** For use with MATHSPAK it extends BASIC's reserve word list. MicroValue price **£9.95 + VAT**
- Logic Soft Relocator** An integrated assembler and disassembler package which allows disassembly and reassembly from anywhere on the memory map. MicroValue price **£13 + VAT**

SAVE MORE MONEY

Standard Firmware for Nascom at Reduced prices

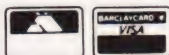
| | | |
|------------------------------|-------------|----------------------------|
| NASPEN | RRP £30 VAT | MicroValue price £20 + VAT |
| Nas-Sys 3 | RRP £25 VAT | MicroValue price £20 + VAT |
| NasDis - D-Bug (EPROM) | RRP £50 VAT | MicroValue price £30 + VAT |
| NasDis - D-Bug (TAPE) | RRP £40 VAT | MicroValue price £20 + VAT |
| Imprint | RRP £30 VAT | MicroValue price £20 + VAT |
| Bits & PCs Prog. Aid | RRP £28 VAT | MicroValue price £20 + VAT |

*MicroValue Warranty

All products, except kits and Nascom Imp, sold by MicroValue dealers are supplied with 12 months warranty and will be replaced or repaired by any dealer (even if you didn't buy it from him) in the group in the event of faulty manufacture.

YOUR LOCAL MICROVALUE DEALER

All the products on these two pages are available while stocks last from the MicroValue dealers listed on right (Mail order enquiries should telephone for delivery dates and post and packing costs.) Access and Barclaycard welcome



MicroValue

MONEY SAVERS

with the exclusive
MicroValue
12 Months
Warranty*

NEW MicroValue Exclusive I/O Board for Nascom & Gemini Multiboard Systems

GM816 Gemini I/O board

The new! GM816 I/O board takes a unique approach to the problems of interfacing your Nascom or Gemini Multi-board to external devices. This 80 Bus and Nasbus compatible card is supplied fully built, populated and tested and includes three Z80 PICs, a CTC and a Real Time Clock with battery back-up. In addition, a range of "daughter" boards that attach straight to the I/O board are under development catering for a wide variety of interfacing requirements.

GM 816 Gemini I/O board
MicroValue price - **£125 + VAT**

Prototyping daughter board
MicroValue price - **£20 + VAT**

IEEE-488

The EV Computers' IEEE-488 card is an 80 Bus and Nasbus compatible card designed to fully implement all IEEE-488 interface functions. This built and tested card gives the user a very cost effective and versatile method of controlling any equipment fitted with a standard IEEE-488 or GPIB interface.

MicroValue introductory price
£140 + VAT

Nascom 3 available from MicroValue

Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.



8K system
MicroValue price -
£416 + VAT

16K system
MicroValue price -
£476 + VAT

Dual floppy disk unit (0.7 MB storage)
MicroValue price -
£685 + VAT

CP/M 2.2
MicroValue price -
£100 + VAT

INTERFACE COMPONENTS LTD.
Oakfield Corner, Sycamore Road,
Amersham, Bucks.
Tel: (02403) 22307. Tlx: 837788.

COMPUTER INTERFACING & EQUIPMENT LTD.
The MICRO-SPARES Shop,
19 Roseburn Terrace,
Edinburgh EH12 5NG
Tel: (031) 337 5611

E. V. COMPUTING
700 Burnage Lane, Burnage,
Manchester M19 1NA.
Tel: (061) 431 4866.

ELECTROVALUE LTD.
28 St Judes, Englefield Green,
Egham, Surrey TW20 0HB.
Tel: (0784) 33603. Tlx: 264475.

SKYTRONICS,
2 North Road, The Park,
Nottingham.
Tel: (0602) 45053/45215

TARGET ELECTRONICS
16 Cherry Lane, Bristol BS1 3NG.
Tel: (0272) 421196.

BITS & PC'S
4 Westgate, Wetherby, W. Yorks.
Tel: (0937) 63774.

HENRY'S RADIO
404 Edgware Road, London W2.
Tel: (01) 402 6822.
Tlx: 262284 (quote ref: 1400).

LEEDS COMPUTER CENTRE,
62 The Balcony,
Merion Centre, Leeds.
Tel: (0532) 458877

Wherever you are in the UK there's a Genie dealer nearby



Genie I & II Approved Dealers

AVON Microstyle, Bath, 0225 334659/319705. **BEDFORD** Conserve, Bedford, 0234 216749. **BERKSHIRE** P.C.P., Reading, 0734 589249. **BIRMINGHAM** Ward Electronics, Birmingham, 021 554 0708. Consultant Electronics, Birmingham, 021 382 7247. A. E. Chapman and Co., Cradeley Heath, 0384 66497/8. **BUCKINGHAMSHIRE** Photo Acoustics, Newport Pagnell, 0908 610625. **CAMBRIDGESHIRE** Cambridge Micro Computers, Cambridge, 0223 314666. **CHESHIRE** Hewart Electronics, Macclesfield, 0625 22030. Mid Shires Computer Centre, Crewe, 0270 211086. **CUMBRIA** Kendal Computer Centre, Kendal, 0539 22559. **DORSET** Blandford Computers, Blandford Forum, 0258 53737. Parkstone Electrics, Poole, 0202 746555. **ESSEX** Emprise, Colchester, 0206 865926. **GLOUCESTERSHIRE** Computer Shack, Cheltenham, 0242 584343. **HERTFORDSHIRE** Photo Acoustics, Watford, 0923 40698. Q Tek Systems, Stevenage, 0438 65385. Chrisalid Systems and Software, Berkhamstead, 044 27 74569. **KENT** Swanley Electronics, Swanley, 0322 64851. **LANCASHIRE** Harden Microsystems, Blackpool, 0253 27590. Sound Service, Burnley, 0282 38481. Computercat, Leigh, 0942 605730. **LEICESTERSHIRE** Kram Electronics, Leicester, 0533 27556. **LONDON** City Microsystems, EC2, 01 588 7272/4. Wason Microchip, N18, 01 807 1757/2230. Premier Publications, Anerley SE20, 01 659 7131. **NORTH EAST** Briers Computer Services, Middlesbrough, 0642 242017. General Northern Microcomputers, Hartlepool, 0783 863871. HCCS Associates, Gateshead, 0632 821924. **NOTTINGHAMSHIRE** Midland Microcomputers, Nottingham, 0602 298281. Mansfield Computers, Mansfield, 0623 31202. East Midland Computer Services, Arnold, 0602 267079. Electronic Servicing Co., Lenton, 0602 783938. **NORFOLK** Anglia Computer Centre, Norwich, 0603 29652. Bennetts, Dereham, 0362 2488/9. **OXFORDSHIRE** Micro Business Systems, Whitney, 0993 73145. **SCOTLAND** Escoc Computing, Glasgow 041 427 5497. Edinburgh: 031 557 3937. Computer and Chips, St Andrews, 0334 72569. Scotbyte Computers, Edinburgh, 031 343 1005. Victor Morris and Co., Glasgow, 041 221 8958. **SHROPSHIRE** Tarrant Electronics, Newport, 0952 814275. **SOUTH WEST** Diskwise, Plymouth (0752) 267000. West Devon Electronics, Yelverton, 082 285 3434. Bits and Bytes, Barnstaple, 0271 72789. **SUFFOLK** Elgelec Ltd., Ipswich, 0473 711164. **SURREY** Croydon Computer Centre, Thornton Heath, 01 689 1280. **WALES** Tryfan Computers, Bangor, 0248 52042. **WEST MIDLANDS** Allen TV Services, Stoke on Trent, 0782 616929. **WILTSHIRE** Everyman Computers, Westbury, 0373 823764. **YORKSHIRE** Media 5 Ltd; Sowerby Bridge 0422 33580. Advance TV Services, Bradford, 0274 585333. Huddersfield Computer Centre, Huddersfield, 0484 20774. Compnite, Bradford, 0274 668890. Superior Systems Ltd., Sheffield, 0742 755005. Photo Electrics, Sheffield, 0742 53865. **NORTHERN IRELAND** Business Electronic Equipment, Belfast, 0232 46161. Brittain Laboratories, Belfast 0232 28374.



Sole Importers:

LOWE electronics

Chesterfield Road, Matlock, Derbyshire DE4 5LE.
Telephone: 0629 4995. Telex: 377482 Lowlec G.






REFLECTIONS

G W Gallagher

The next stage in our look at elementary graphics programming is the construction of border patterns.

When translation parallel to one chosen direction is added to the transformations of reflection and rotation (covered in last month's CT), we can now generate seven different border patterns from one element of pattern.

The border itself, produced to infinity in either direction, must have the same order of symmetry as the point symmetry developed with the pattern element. For example, if the basic element is reflected in an axis parallel to the direction of translation before being translated, then the whole of the border pattern has reflective symmetry of the same order. This restricts the point symmetries which may be used to the following types:

- A.  Rotation through 360 degrees, ie the basic element itself.
- B.  Reflection in an axis perpendicular to the direction of translation.
- C.  Reflection in an axis parallel to the direction of translation.
- D.  Reflection in both these axes.
- E.  Rotation through 180 degrees about a point on the axis of translation.

The seven border patterns are then generated as follows:

- 1. Translation of the basic unit A.



- 2. Translation of B.



- 3. Translation of C.



- 4. Translation of D.



- 5. Translation of A, followed by reflection (called a glide reflection).



- 6. Glide reflection of B.



- 7. Translation of E.



Back To Basics

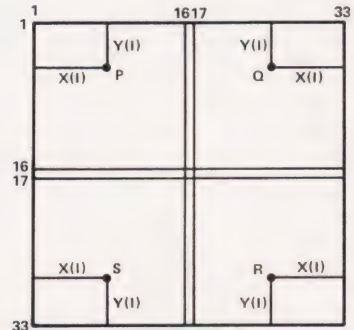
The basic element in the program is contained in a 16 by 16 square of points. The co-ordinates of the points are either read in as data or given as input from the keyboard using arrays X(88) and Y(88) to hold the values of x and y.

Lines 100-116 contain the data for a basic shape, in this case, 67 points. The co-ordinates, enclosed within the 16 by 16 square, are read in point by point, the y co-ordinate following the x co-ordinate. Line 120 passes on the number of points, N, to the pattern-making program.

```
130 FOR I=1 TO N:
    READ X(I),Y(I):
    NEXT I
```

Lines 500 to 590 contain the program to build up the basic shape to be used from the keyboard, with a maximum of 88 points (see last month's article on Point Symmetry).

To form shapes A,B,C,D and E



Consider one point P of the basic shape.

P has co-ordinates X(I),Y(I)

Q 33-X(I),Y(I)

R 33-X(I),33-Y(I)

S X(I),33-Y(I)

Shape A uses point P

```
2000 HGR:HCOLOR=3:
    FOR I=1 TO N:
    P=100+X(I):Q=40+Y(I):
    H PLOT P,Q:
    NEXT I:
    RETURN
```

Shape B uses points P and Q

```
2100 HGR:HCOLOR=3:
    FOR I=1 TO N:
    P1=100+X(I):Q1=40+Y(I):
    P2=133-X(I):Q2=Q1:
    H PLOT P1,Q1:H PLOT P2,Q2:
    NEXT I:
    RETURN
```

Shape C uses points P and S

```
2200 HGR:HCOLOR=3:
    FOR I=1 TO N:
    P1=100+X(I):Q1=40+Y(I):
    P2=P1:Q2=73-Y(I):
    H PLOT P1,Q1:H PLOT P2,Q2:
    NEXT I:
    RETURN
```

Shape D uses points P,Q,R and S

```
2300 HGR:HCOLOR=3:
    FOR I=1 TO N:
    P1=100+X(I):Q1=40+Y(I):
    P2=133-X(I):Q2=Q1:
    P3=P1:Q3=73-Y(I):
    P4=P2:Q4=Q3:
    H PLOT P1,Q1
    H PLOT P2,Q2:H PLOT P3,Q3:
    H PLOT P4,Q4:
    NEXT I:
    RETURN
```

Shape E uses points P and R

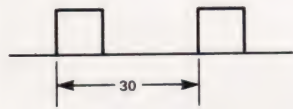
```
2400 HGR:HCOLOR=3:
    FOR I=1 TO N:
    P1=100+X(I):Q1=40+Y(I):
    P2=133-X(I):Q2=73-Y(I):
    H PLOT P1,Q1:H PLOT P2,Q2:
    NEXT I:
    RETURN
```

On The Border

Having worked out the basic shapes, it is then necessary to move them horizontally across the screen for regular distances. The line of translation used is, on the Apple screen, 100 units from the top of the screen, and is shown in Pattern 1 which is the basic element A translated.

```
2500 FOR K=1 TO 270 STEP 2:
    HPLLOT K,100:
    NEXT K
```

Pattern 1. Element A (16 by 16) will fit into the width of the screen eight times if a distance of 30 units is placed between the same points on consecutive repeats.



```
2520 FOR J=0 TO 7:FOR I=1 TO N:
    P=J*30+X(I):Q=84+Y(I):
    HPLLOT P,Q:
    NEXT I
2560 GOSUB 4100:
    NEXT J:
    RETURN
```

The line of translation is then erased by plotting with HCOLOR=0.

```
2570 HCOLOR=0:
    FOR K=1 TO 270:
    HPLLOT K,100:
    NEXT K:
    RETURN
```

The end of each repeat of the pattern is marked by a 'bleep'.

```
4100 FOR B=1 TO 10:
    S=PEEK(-16336):
    NEXT B:
    RETURN
```

Pattern 2. The element B is 33 points wide and 16 points deep. It is repeated seven times across the screen, with a distance of 35 units between consecutive repeats of the same point of B.



```
2700 FOR J=0 TO 6:FOR I=1 TO N:
    P1=J*35+X(I):Q1=84+Y(I):
    P2=J*35+33-X(I):Q2=Q1:
    HPLLOT P1,Q1:HPLLOT P2,Q2:
    NEXT I
2800 GOSUB 4100:
    NEXT J:
    RETURN
```

Pattern 3. The element C is 16 points wide, 33 points deep and is repeated seven times across the screen.



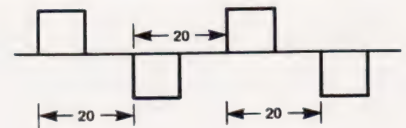
```
2900 FOR J=0 TO 6:FOR I=1 TO N:
    P1=J*35+X(I):Q1=84+Y(I):
    P2=P1:Q2=117-Y(I):
    HPLLOT P1,Q1:HPLLOT P2,Q2:
    NEXT I
3000 GOSUB 4100:
    NEXT J:
    RETURN
```

Pattern 4. The element D is 33 points wide and 33 points deep and is again repeated seven times across the screen.



```
3100 FOR J=0 TO 6:FOR I=1 TO N:
    P1=J*35+X(I):Q1=84+Y(I):
    P2=P1:Q2=117-Y(I):
    P3=J*35+33-X(I):Q3=Q1:
    P4=P3:Q4=Q2
3170 HPLLOT P1,Q1:HPLLOT P2,Q2:
    HPLLOT P3,Q3:HPLLOT P4,Q4:
    NEXT I
3250 GOSUB 4100:
    NEXT J:
    RETURN
```

Pattern 5. The element A is itself 16 by 16 points but the element is reflected in the axis of translation, half way between the repeats of element A.



```
3300 FOR J=0 TO 5:FOR I=1 TO N:
    P1=J*40+X(I):Q1=84+Y(I):
    HPLLOT P1,Q1:
    NEXT I
3400 FOR I=1 TO N:
    P2=J*40+X(I)+20:Q2=117-Y(I):
    HPLLOT P2,Q2:
    NEXT I
3410 P2=J*40+X(I)+20:Q2=117-Y(I)
3450 GOSUB 4100:
    NEXT J:
    RETURN
```

Pattern 6 The glide reflection is formed as in Pattern 5, using the element B (33 by 16 points).



```
3500 FOR J=0 TO 5:FOR I=1 TO N:
    P1=J*40+X(I):Q1=84+Y(I):
    P2=J*40+33-X(I):Q2=Q1:
    HPLLOT P1,Q1:HPLLOT P2,Q2:
    NEXT I
3580 FOR I=1 TO N:
    P3=J*40+20+X(I):Q3=117-Y(I):
    P4=J*40+20+33-X(I):Q4=Q3:
    HPLLOT P3,Q3:HPLLOT P4,Q4:
    NEXT I
3635 GOSUB 4100:
    NEXT J:
    RETURN
```

Pattern 7. The element E is 33 by 33 points and is repeated six times.



```
3700 FOR J=0 TO 5:FOR I=1 TO N:
    P1=J*40+X(I):Q1=84+Y(I):
    HPLLOT P1,Q1:
    NEXT I
3800 FOR I=1 TO N:
    P2=J*40+33-X(I):Q2=117-Y(I):
    HPLLOT P2,Q2:
    NEXT I
3850 GOSUB 4100:
    NEXT J:
    RETURN
```

These are the seven different border patterns which may be formed to satisfy the symmetrical relationships. Having programmed these, the next step would be to add translation parallel to a second direction thus forming the plane patterns satisfying the same rules of symmetry.



Program Listing

```

5 DIM X(88),Y(88)
10 HOME : UTAB 8: HTAB 9: PRINT "*****"
11 HTAB 9: PRINT " * "
12 HTAB 9: PRINT " * STRIP * "
13 HTAB 9: PRINT " * "
14 HTAB 9: PRINT " * PATTERNS * "
16 HTAB 9: PRINT " * G.H.GALLAGHER * "
17 HTAB 9: PRINT " * 1982 * "
18 HTAB 9: PRINT " * "
19 HTAB 9: PRINT "*****"
25 FOR I = 1 TO 1000: NEXT I
30 HOME : UTAB 3: PRINT " THE TRANSFORMATIONS OF "
40 UTAB 5: PRINT "REFLECTION AND ROTATION LINKED WITH"
50 UTAB 7: PRINT "TRANSLATION PARALLEL TO ONE DIRECTION"
60 UTAB 9: PRINT "FORM 7 DIFFERENT INFINITE STRIP"
70 UTAB 11: PRINT "OR RIBBON PATTERNS"
75 GOSUB 4000
80 HOME : PRINT "TYPE 1 TO SEE A SET OF EXAMPLES"
82 UTAB 3: PRINT "TYPE 2 TO FORM YOUR OWN DESIGN"
84 INPUT A: IF (A - 1) * (A - 2) < > 0 THEN 84
86 ON A GOTO 120,500
900 DATA 1,1,2,1,3,1,4,1,5,1,5,2,5,3,5,4,5,5,4,5,3,5,2,5,1,5,1,4,1,3,1,2,
2,2,3,2,4,2,3,3,3,3,5,2,4,3,4,4,4,4
110 DATA 5,6,6,6,7,6,8,6,8,7,7,7,6,7,5,7,5,8,6,8,7,8,8,8,9,7,9,6,9,5,9
115 DATA 8,10,8,10,10,10,10,11,9,11,8,11,8,12,9,12,10,12,10,13,11,14,11,1,
3,12,15,13,15,14,15,15,16,15,16,16,15,16,14,16,13,18,12,16,15,14,1
6,14,16,13
116 DATA 11,13
120 X = FRE (0):N = 67
130 FOR I = 1 TO N: READ X(I),Y(I): NEXT I
140 HOME : UTAB 21: PRINT "THIS IS THE BASIC ELEMENT"
141 GOSUB 2000
143 FOR I = 1 TO 2000: NEXT I
145 GOSUB 4000
150 HOME : UTAB 21: PRINT "THIS IS THE BASIC ELEMENT REFLECTED"
152 PRINT "IN A VERTICAL AXIS"
155 GOSUB 2100
160 FOR I = 1 TO 2000: NEXT I
165 GOSUB 4000
170 HOME : UTAB 21: PRINT "THIS IS THE BASIC ELEMENT REFLECTED"
172 PRINT "IN A HORIZONTAL AXIS"
180 GOSUB 2300
181 FOR I = 1 TO 2000: NEXT I
185 GOSUB 4000
190 HOME : UTAB 21: PRINT "THIS IS THE BASIC ELEMENT REFLECTED"
192 PRINT "IN TWO AXES"
194 GOSUB 2300
196 FOR I = 1 TO 2000: NEXT I
198 GOSUB 4000
200 HOME : UTAB 21: PRINT "THIS IS THE BASIC ELEMENT ROTATED THROUGH
H 180 DEGREES"
201 GOSUB 2400
205 FOR I = 1 TO 2000: NEXT I
206 GOSUB 4000
210 HOME : UTAB 21: PRINT "1. THE PATTERN FORMED BY TRANSLATION"
212 PRINT "OF THE BASIC ELEMENT"
220 GOSUB 2000: GOSUB 2500: GOSUB 4000
230 HOME : UTAB 21: PRINT "2.THE BASIC ELEMENT REFLECTED IN A"
232 PRINT "VERTICAL AXIS AND TRANSLATED"
240 GOSUB 2100: GOSUB 2700: GOSUB 4000
250 HOME : UTAB 21: PRINT "3.THE BASIC ELEMENT REFLECTED IN A "
252 PRINT "HORIZONTAL AXIS AND TRANSLATED"
260 GOSUB 2200: GOSUB 2900: GOSUB 4000
270 HOME : UTAB 21: PRINT "4.THE BASIC ELEMENT REFLECTED IN"
272 PRINT "BOTH AXES AND TRANSLATED"
280 GOSUB 2300: GOSUB 3100: GOSUB 4000
290 HOME : UTAB 21: PRINT "5.THE BASIC ELEMENT IN A GLIDE"
292 PRINT "REFLECTION"
300 GOSUB 2000: GOSUB 3300: GOSUB 4000
310 HOME : UTAB 21: PRINT "6.REFLECTION FOLLOWED BY A GLIDE"
312 PRINT "REFLECTION"
320 GOSUB 2100: GOSUB 3500: GOSUB 4000
330 HOME : UTAB 21: PRINT "7.THE BASIC ELEMENT ROTATED ABOUT A"
332 PRINT "POINT ON THE LINE OF TRANSLATION AND"
333 PRINT "THEN TRANSLATED"
340 GOSUB 2400: GOSUB 3700: GOSUB 4000
350 TEXT : HOME : PRINT "TYPE 1 TO SEE THE EXAMPLE AGAIN"
360 PRINT "TYPE 2 TO MAKE YOUR OWN BASIC ELEMENT"
370 PRINT "TYPE 3 TO FINISH": INPUT A: IF (A - 1) * (A - 2) * (A - 3) < >
0 THEN 350
380 ON A GOTO 120,500,1000
500 HOME
501 PRINT "1.1 16.1"
505 PRINT " *****"
506 PRINT " *****"
507 PRINT " *****+0* THE 0 IS AT 14.3"
510 PRINT " *****"
515 PRINT " *****"
517 PRINT " *****"
520 PRINT " *****"
522 PRINT " *****"
525 PRINT " *****"
527 PRINT " *****"
530 PRINT " *****"
531 PRINT " *****"
532 PRINT " *****"
533 PRINT " *****"
535 PRINT " *****S***** THE S IS AT 11.15"
540 PRINT " *****"
555 PRINT "1.16 16.16"
556 I = 1
560 UTAB 21: PRINT "A POINT,PLEASE,IN THE FORM A,B"
562 PRINT "TYPE 0,0 WHEN YOUR LIST IS COMPLETE"
563 INPUT A,B:C = B + 1:D = A + 3
564 IF A = 0 AND B = 0 THEN GOTO 590
568 X(I) = A:Y(I) = B: UTAB C: HTAB D: PRINT " :
570 I = I + 1: IF I > 88 THEN 585
580 GOTO 560
585 HOME : PRINT "THERE IS A MAXIMUM NUMBER OF POINTS(88),YOUR PATTERN IS
ASSUMED TO BE COMPLETE"
590 N = I - 1: GOTO 140
1000 END
2000 HGR : HCOLOR = 3: FOR I = 1 TO N:P = 100 + X(I):Q = 40 + Y(I): HPLLOT
P,Q: NEXT I: RETURN
2100 HGR : HCOLOR = 3: FOR I = 1 TO N:P1 = 100 + X(I):Q1 = 40 + Y(I):P2 =
133 - X(I):Q2 = Q1: HPLLOT P1,Q1: HPLLOT P2,Q2: NEXT I: RETURN
2200 HGR : HCOLOR = 3: FOR I = 1 TO N:P1 = 100 + X(I):Q1 = 40 + Y(I):P2 =
P1:Q2 = 73 - Y(I): HPLLOT P1,Q1: HPLLOT P2,Q2: NEXT I: RETURN
2300 HGR : HCOLOR = 3: FOR I = 1 TO N:P1 = 100 + X(I):Q1 = 40 + Y(I):P2 =
133 - X(I):Q2 = Q1:P3 = P1:Q3 = 73 - Y(I):P4 = P2:Q4 = Q3: HPLLOT P1,Q
1
2310 HPLLOT P2,Q2: HPLLOT P3,Q3: HPLLOT P4,Q4: NEXT I: RETURN
2400 HGR : HCOLOR = 3: FOR I = 1 TO N:P1 = 100 + X(I):Q1 = 40 + Y(I):P2 =
133 - X(I):Q2 = 73 - Y(I): HPLLOT P1,Q1: HPLLOT P2,Q2: NEXT I: RETURN
2500 FOR K = 1 TO 270 STEP 2: HPLLOT K,100: NEXT I
2520 FOR J = 0 TO 7: FOR I = 1 TO N:P = J + 30 + X(I):Q = 84 + Y(I): HPLLOT
P,Q: NEXT I
2550 GOSUB 4100: NEXT J
2570 HCOLOR = 0: FOR K = 1 TO 270: HPLLOT K,100: NEXT K: RETURN
2700 FOR J = 0 TO 6: FOR I = 1 TO N:P1 = J + 35 + X(I):Q1 = 84 + Y(I):P2 =
J + 35 + 33 - X(I):Q2 = Q1: HPLLOT P1,Q1: HPLLOT P2,Q2: NEXT I
2800 GOSUB 4100: NEXT J: RETURN
2900 FOR J = 0 TO 6: FOR I = 1 TO N:P1 = J + 35 + X(I):Q1 = 84 + Y(I):P2 =
P1:Q2 = 117 - Y(I): HPLLOT P1,Q1: HPLLOT P2,Q2: NEXT I
3000 GOSUB 4100: NEXT J: RETURN
3100 FOR J = 0 TO 6: FOR I = 1 TO N:P1 = J + 35 + X(I):Q1 = 84 + Y(I):P2 =
P1:Q2 = 117 - Y(I):P3 = J + 35 + 33 - X(I):Q3 = Q1:P4 = F3:Q4 = Q2
3170 HPLLOT P1,Q1: HPLLOT P2,Q2: HPLLOT P3,Q3: HPLLOT P4,Q4: NEXT I
3250 GOSUB 4100: NEXT J: RETURN
3300 FOR J = 0 TO 5: FOR I = 1 TO N:P1 = J + 40 + X(I):Q1 = 84 + Y(I): HPLLOT
P1,Q1: NEXT I
3400 FOR I = 1 TO N:P2 = J + 40 + X(I) + 20:Q2 = 117 - Y(I): HPLLOT P2,Q2:
NEXT I
3410 P2 = J + 40 + X(I) + 20:Q2 = 117 - Y(I)
3450 GOSUB 4100: NEXT J: RETURN
3500 FOR J = 0 TO 5: FOR I = 1 TO N:P1 = J + 40 + X(I):Q1 = 84 + Y(I):P2 =
J + 40 + 33 - X(I):Q2 = Q1: HPLLOT P1,Q1: HPLLOT P2,Q2: NEXT I
3580 FOR I = 1 TO N:P3 = J + 40 + 20 + X(I):Q3 = 117 - Y(I):P4 = J + 40 +
20 + 33 - X(I):Q4 = Q3: HPLLOT P3,Q3: HPLLOT P4,Q4: NEXT I
3635 GOSUB 4100: NEXT J: RETURN
3700 FOR J = 0 TO 5: FOR I = 1 TO N:P1 = J + 40 + X(I):Q1 = 84 + Y(I): HPLLOT
P1,Q1: NEXT I
3800 FOR I = 1 TO N:P2 = J + 40 + 33 - X(I):Q2 = 117 - Y(I): HPLLOT P2,Q2:
NEXT I
3950 GOSUB 4100: NEXT J: RETURN
4000 UTAB 23: PRINT "PRESS ANY KEY WHEN YOU ARE READY TO"
4010 PRINT "CONTINUE"
4011 PRINT " "
4020 GET A$: IF A$ = "" THEN GOTO 4020
4030 RETURN
4100 FOR B = 1 TO 10:S = PEEK ( - 16336): NEXT B: RETURN

```

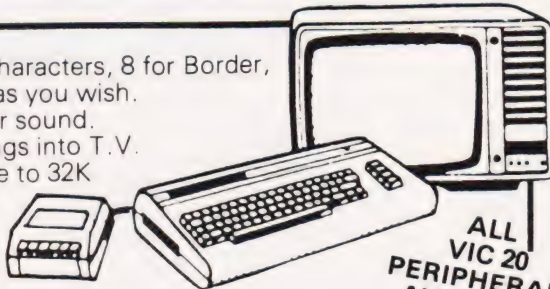
CHROMASONIC electronics

48 JUNCTION ROAD, ARCHWAY LONDON N19 5RD 100 yds FROM ARCHWAY STATION & 9 BUS ROUTES
TELEPHONE: 01-263 9493/01-263 9495 TELEX: 22568.

YOUR SOUNDEST CONNECTION IN THE WORLD OF COMPUTERS

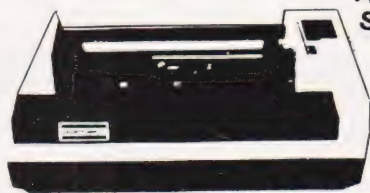
VIC 20

- * 24 Colours, 8 for Characters, 8 for Border, 16 for screen mixed as you wish.
 - * 3 tone Generator for sound.
 - * Uses Pet Basic *Plugs into T.V.
 - * Memory expandable to 32K
 - * VIC complete with T.V. Modulator and Power Supply
- ONLY £165.00**



VIC Cassette Deck
ONLY £34.00

Available now
VIC Dot Matrix Printer
80 Column, 30 CPS,
Tractor Feed
ONLY £175.00



ALL
VIC 20
PERIPHERALS
AVAILABLE
SEND FOR
LIST

UK101

DOWN
IN PRICE

- UK101 Kit inc 8K memory **£125**
- Ready Built inc 8K memory **£175**
- 4K Expansion 8x2114 **£10**
- Parallel Printer Interface **£19.95**
- Chromasonics Sound Kit **£19.95**
- Colour Kit **£59.95**

NEW — NEW — NEW

- 32K Dynamic Memory Board only **£79.95**
- P.I.O. and Eprom Programmer Kit only **£19.95**
- J1 Expander only **£9.95**

NEW LOW PRICE

APPLE II PLUS

- AUTOSTART "EUROPLUS" 48K Apple Computer **579.00**
- Disc Drive with Controller **300.00**
- Disc Drive without Controller **250.00**
- Colour Card **69.00**
- Silentype Printer **180.00**
- Graphics Tablet **425.00**
- TV Modulator **14.00**

A range of APPLE accessories and Software are available.



PET

- 4016 16K RAM **445.00**
 - 4032 32K RAM **560.00**
 - 8032 32K RAM **755.00**
 - 8096 96K RAM **1040.00**
 - 4040 Disk Drive **560.00**
 - 8050 Disk Drive **755.00**
 - 4022 Printer 80 Col **350.00**
 - 8023 NEW printer **785.00**
 - 8026 Printer/Typewriter **835.00**
 - 2031 Single Drive **349.00**
- A range of PET accessories and Software are available.



PRINTERS

INTERFACES AND CABLES FOR APPLE II, PET, TRS80, RS232, UK101, SHARP SUPERBOARD ALL AVAILABLE.



EPSON MX80 £320
Dot-matrix printer with Pet graphics interface. Centronics parallel and serial. Pet and Apple compatible. True bidirectional, 80 cps.

EPSON MX82 £355
As MX80 plus high Resolution Graphics

EPSON MX80 FT/1 £340
Dual single sheet friction and tractor feed, 9 wire head, true descenders.

EPSON-MX80 FT/2 £380
An FT/1 with high resolution graphics.

SEIKOSHA GP80A £195
Dot matrix 5 x 7, 80 columns, 30 cps graphics, double width characters.

EPSON MX100 ONLY £480

VIDEO GENIE

Utilises Z80, 12K level II basic, Integral Cassette Deck, UHF O/P, 16K RAM, all TRS80 features. Simply plugs into monitor or UHF TV. With V.U. Meter. Now with lower case and Sound.

GENIE 1 £299.

- PARALLEL PRINTER INTERFACE INC CABLE **£38.00**
- CHROMASONICS PROGRAMMABLE SOUND KIT **£24.50**
- SOUND KIT (FITTING EXTRA) **£8.20**
- LOWER CASE KIT (FITTING EXTRA) **£29.80**
- COLOUR KIT (FITTING EXTRA) **£36.00**
- EXPANSION BOX INC 16K RAM **£199**
- 16K/32K RAM BOARD **£94/£129**
- NEW GENIE II NOW AVAILABLE£310**

MONITORS

HITACHI PROFESSIONAL

- 9" Green Screen **£99.00**
- 12" Green Screen **£125.00**
- 12" BMC Green Screen **£110.00**
- 9" **£99.95**
- 12" **£149.00**

TANTEL

PRESTEL BY TANTEL
COMMUNICATIONS AT YOUR FINGERTIPS
FOR BUSINESS & HOME. UP TO DATE INFO

180,000 pages of information on Travel, News, Investment, Holidays, Hotels Etc., Etc.

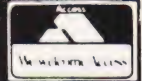
£159

TANTEL IS POST OFFICE APPROVED. SEND FOR DETAILS.
DEMONSTRATION AVAILABLE AT OUR SHOWROOM.

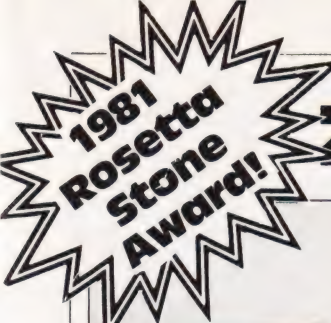
ALL ITEMS CARRY 1 YEAR GUARANTEE



Please add VAT 15% to all prices. Postage on computers, printers and cassette decks charged at cost, all other items P&P 30p. Place your order using your Access or Barclaycard (Min. tel. order £10). Export enquiries welcome. Official orders welcome.



Prices valid for cover date of this magazine only.



ZX81 ROM EXPOSED!



ZX81 ROM Disassembly Part A
 This book is for the programmer that needs complete answers about the ZX81. Dr. Logan has examined all routines in the ROM and here he comments on each one. It covers all ROM locations from 0000H to 0F54H, and includes all functions except for the routines used in the floating point calculator.

ZX81 ROM Disassembly Part B
 In this the companion volume to Part A Dr. Logan covers locations 0F55H to 1DFFH and includes all routines used in the ZX81 floating point calculator.

OTHER TITLES AVAILABLE
 ★ **Machine Language Programming Made Simple for the Sinclair**
 ★ **Not Only 30 Programs for the Sinclair ZX81: 1K** —
 ★ **Complete Sinclair ZX81 Basic Course** is a 240 page in-depth comprehensive for complete beginners and experienced programmers. Over 100 programs and examples illustrate the use and possibilities of the Sinclair ZX81:
 • programming techniques and memory saving devices
 • every function covered
 • BASIC Course programs available on cassette

Dr. Ian Logan, winner of the 1981 Rosetta Stone Award has written three essential books for those who really want to understand the full working of the SINCLAIR ZX81!

Understanding Your ZX81 ROM
 In this book Dr. Logan gives a complete overview of Z80 machine language using the ZX81 monitor program as an example. Dr. Logan explains the structure of the ZX81 ROM, its peculiarities, and how you can use the ZX81 ROM routines for your own purposes. PLUS a special section which shows how you can squeeze more power into your ZX81 by using machine language and machine language subroutines. Complete with example programs, reference tables, etc.

Orders to Melbourne House Publishers 131 Trafalgar Road, Greenwich London SE10
 (Correspondence to: Glebe Cottage, Station Road, Cheddington, Leighton Buzzard, BEDS LU7 7NA)

NAME CT
 ADDRESS
 Postcode

| | | | | | |
|---------------------------------------|--------|--------------------------|--|-------------|--------------------------|
| Understanding Your ZX81 ROM | £8.95 | <input type="checkbox"/> | Not Only 30 Programs/Sinclair ZX81:1K | £6.95 | <input type="checkbox"/> |
| ZX81 ROM Disassembly Part A | £7.00 | <input type="checkbox"/> | Machine Language Programming Made Simple | £8.95 | <input type="checkbox"/> |
| ZX81 ROM Disassembly Part B | £8.00 | <input type="checkbox"/> | | | |
| The Complete Sinclair ZX BASIC Course | £17.50 | <input type="checkbox"/> | | | |
| Basic Course Programs on Cassette | £2.50 | <input type="checkbox"/> | | | |
| | | | Postage and Packing | £0.80 | |
| | | | Remittance enclosed | £ | |

OSBORNE-1. THE UNIQUE MICROCOMPUTER!

The OCC1 represents a genuine advance in computer cost effectiveness. See what you get for its remarkably low price of **£1250**:

- self-contained, portable system
- powerful microcomputer – Z80A, 64K, CP/M
- built-in display screen with twin disks
- word-processing and financial planning software

Think of the possibilities – a powerful word-processor; a flexible management computer; a low-cost software development system; a portable remote terminal – all for only **£1250 (+ VAT)**. Let's show you the unique Osborne-1 – you'll be impressed.

Cambridge Computer Store

1 Emmanuel Street, Cambridge CB1 1NE
 Telephone (0223) 65334/5

also, Tandy Apple Hewlett-Packard Sirius North Star Acorn Sinclair Commodore

SALE ELECTRONIC GAMES



NOW £40 OFF

ATARI T.V. GAME

THE GAME WITH 50 CARTRIDGES
 R.R.P. £129.95 (inc. VAT)
OUR PRICE
£78.22 + VAT
 (= £89.95 inc. VAT)
 The Atari is supplied with a free mains adaptor, a pair of paddles, a pair of joysticks and a combat cartridge and is the most popular television game on the market and has a range of over 40 different cartridges. In addition to the standard Atari range we also now stock the new Activision cartridges which are currently on special offer reduced from £18.95 to **£16.95 inc. VAT**

ATARI CARTRIDGES
20% OFF R.R.P.
 Atari Soccer £29.95
NOW £23.95
 Activision Dragster £18.95
NOW £14.95
 Activision Boxing £18.95
NOW £14.95

ATARI OWNERS CLUB — Why not join our **FREE** Silica Atari Owners Club and receive our bi-monthly newsletter with special offers and details of the latest new cartridge releases. Telephone us with your name and address and we will add your name to our computer mailing list.

MATTEL INTELLIVISION



NOW £50 OFF

THE ULTIMATE T.V. GAME
 R.R.P. £229.95 (inc. VAT)

OUR PRICE
£156.48 + VAT
 (£179.95 inc. VAT)

6 NEW CARTRIDGES JUST RELEASED
 ASTROSMASH * SNAFU * BOWLING
 SPACE ARMADA * BOXING
 TRIPLE ACTION
 All 19 current cartridges + the six new ones above now retail at £19.95 — Silica special offer price **£17.95 inc. VAT**

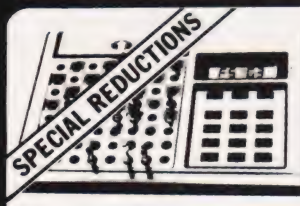
The Mattel Intellivision is the most advanced T.V. game in the world with a range of over 25 different cartridges all at our special offer price of £17.95. This game uses a 16-bit microprocessor giving 16 colours and three-part harmony sound. The picture quality is incredible with 3D effects and realistic animation. An add-on keyboard will be available in the Spring 1982 to convert the Mattel into a full home computer with 16K RAM which will be fully expandable and programmable in Microsoft Basic. Other accessories will be added later in the year. The normal price of the Intellivision + free soccer cartridge is £229.95 but our special offer price is £179.95 inc. VAT saving you £50.00

MATTEL OWNERS CLUB — Why not join our Mattel Owners Club and receive our regular newsletters containing details of all the latest cartridge releases. Telephone us with your name and addresses and we will add your name to our computer mailing list.

FREE 16 PAGE CARTRIDGE CATALOGUE — If you are interested in owning a Mattel, we now have available a 16 page catalogue describing the latest six cartridges to be released, as well as a new Mattel colour leaflet with brief descriptions of all 25 cartridges. Telephone us for further details.

T.V. GAME CARTRIDGES

We specialise in the whole range of T.V. games and sell cartridges for the following games **ATARI * MATTEL * ACETRONIC * PHILIPS * DATABASE * ROWTRON * INTERTON * TELENG**. Let us know if you own any of these games and we will let you have details of the range of cartridges available. Attention INTERTON & ACETRONIC owners we have over 75 assorted used cartridges in stock all with 1 year guarantee — **SPECIAL OFFER £8.95 each**
 We also have a number of secondhand games and cartridges.



SPECIAL REDUCTIONS

ELECTRONIC CHESS

Liquid crystal battery chess computer with 100-200 hrs battery life and two levels of play. Comes with separate chess board and pieces.
NOW £5 OFF
 R.R.P. £24.95
SALE PRICE
£19.95
 (inc. VAT)

GRADUATE CHESS

A deluxe version of the electronic chess set with integral chess board. The ideal portable chess set — see illustration.
NOW
£29.95
 INC VAT

FIDELITY MINI-SENSORY CHESS COMPUTER

The very first chess computer of its price to offer a portable computer with integral sensory board. Battery (6-8 hrs) or mains operated. This is a modular game and additional plug-in modules are planned for 1982 for advanced chess, popular openings, greatest master games, draughts and reversi.

MINI-SENSORY COMPUTER WITH STANDARD CHESS MODULE WAS £54.50 **NOW £49.95 INC. VAT**

Silica Shop are one of the country's leading specialists in Chess Computers and now stock a range of more than 20 Chess Computers including Challenger 7, 10, voice, Sensory 8 and Sensory Voice, Diplomat System 3, Morphy, Great Game Machine, Voice Champion, and the new SciSys Mark V.



NOW £8 OFF

HAND-HELD GAMES EARTH INVADERS

These invaders are a breed of creature hitherto unknown to man. They cannot be killed by traditional methods — they must be buried. The battle is conducted in a maze where squads of aliens chase home troops. The only way of eliminating them is by digging holes and burying them.
R.R.P. £26.95 **NOW £18.95 inc. VAT**



NOW £10 OFF

PAC MAN 2

Pac Man 2 is based on the latest pub game. It is a two-colour game of strategy, tactical pursuit and destruction pitting Pac Man against the large Ghosts. The object of the game is for Pac Man to attain as high a score as possible by capturing and destroying Ghosts, Bugs and Energizers without being himself destroyed by the Ghosts. Pac Man 2 incorporates the most modern and complex status displays ever produced and is now on release for the first in the UK offering an ideal present.
R.R.P. £34.95 **NOW £24.95 inc. VAT**



NOW £8 OFF

SPACE INVADERS

Based on one of the most popular arcade games, Space Invader™ packs in lots of action with multi-shaped, brilliant LED vessels, including attack ships, bombs, defenders, missile rockets and a beam force cannon, plus exciting electronic sound effects. The attack ships attempt to bomb the ground defenders as they are moving. You manoeuvre the missile rockets — avoiding alien bombs — and destroy the invader force as quickly as you can. Progressive degree of difficulty. Includes automatic digital scoring. For ages 6 to adult.
R.R.P. £24.95 **NOW £16.95 inc. VAT**

LESS THAN 1/2 PRICE

COLOUR CARTRIDGE T.V. GAME
 Sem. Programmable T.V. game + 4 cartridges + mains transformer
NOW £43.50 OFF
 R.R.P. £73
SALE PRICE £29.50 inc. VAT

50% PURCHASE NOW 1/2 PRICE

BACKGAMMON COMPUTER
 Single color backgammon computer. Backgammon computer with 2 1/2" x 3 1/2" board. Special offer to £19.95. See illustration.
Was £99.95
NOW £48.95 inc. VAT

CALL THE PRICE OF COMPARABLE MACHINES — **— THE AFFORDABLE ANSWER**

The Post Office certified telephone answering machine

"Sorry darling, I will be late home — Love John"

The Call Jotter 1 brings the affordable answer at the amazing price of £69 (or £99 for the Call Jotter 2 with built-in remote recall facilities). These amazing telephone answering machines are Post Office certified and guaranteed for one year. They make a thoughtful gift for home or business use.

Call Jotter 3 illustrated **NOW £69.00 inc. VAT**
 TWINTAPE £139

NOW £75 OFF

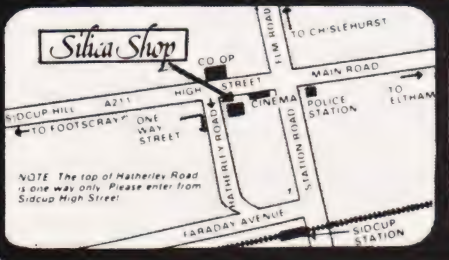
RADOFIN TELETXT

Plug the adaptor into the aerial socket of your colour TV and receive the CEFTA and ORACLE Teletext services.

THIS NEW MODEL INCORPORATES
 "Double strength" strong, durable "Steele" PAL Colour Memory, Super BR & BA (30 channels) super-tube colour control, "Ultra-contrast" contrast control, "Ultra-contrast" contrast control, "Ultra-contrast" contrast control, "Ultra-contrast" contrast control.

ADD-ON ADAPTOR
WAS £199 inc. VAT
SALE PRICE £124 inc. VAT

FOR FREE BROCHURES — TEL: 01-301 1111



For free illustrated brochure and reviews on our range of electronic games please telephone 01 301 1111. Free delivery service available. To order by telephone please quote your name, address and ACCESS BARCLAYCARD number, and leave the rest to us. Post and packing Free of Charge. Express 48 hour delivery service available.

REPAIR SERVICE — Repairs to all electronic games. Silica Shop repair team, based at Sidcup, Kent, are fully equipped to repair all electronic games. Repairs are carried out by our experienced Silica Shop 2 year Guarantee.

MONEY BACK UNDERTAKING — If you are not satisfied with your purchase and return it within 30 days we will give you a full refund.

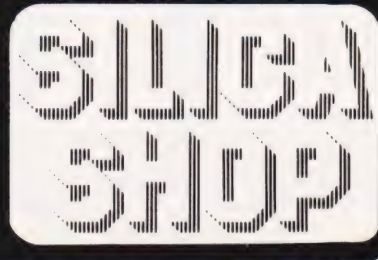
ALTER SALES SERVICE — Available on all machines from 1 year guarantee.

WARRANTY ADDRESS — Silica Shop Limited, Sidcup, Kent.

CREDIT FACILITIES — Full credit facilities available over 12, 24 or 36 months at competitive rates.

RETAIL ADDRESS — Silica Shop Limited, Sidcup, Kent.

SILICA SHOP LIMITED CT0682
 1-4 The Mews, Hatherley Road, Sidcup, Kent DA14 4DX
 Telephone 01-301 1111 or 01-309 1111



OSBORNE REVIEWED

Mike James

After years of writing books on computers and passing comments on the industry's behaviour, Adam Osborne has finally taken the plunge and produced his own portable micro. At the time of reviewing, it was 'selling like hot cakes' on the American market and just beginning to make itself felt in the UK. As to how it fared with our reviewer...read on.

Adam Osborne is a name that might be familiar to you if you're an avid reader of technical books. Back in the dark and terrible days, before CT was even a twinkle in anyone's editorial eye, information on microprocessors was very hard to come by. One much valued source was a series of paperbacks with the general title of 'An Introduction to Microcomputers'. At the time, these volumes were well thought of but looking back they seem very uninspired, especially when compared to the typical micro book published today. However, the series was a success, perhaps because we knew no better or perhaps because there were so few competitors.

The success of the series was also Osborne's success because he not only wrote them but published

them as well and Osborne Associates grew into a publishing house with a worldwide reputation — so much so that about a year or so ago, McGraw-Hill bought Osborne Associates and are now using the name Osborne to endorse their own products!

There is little doubt that much of the success of Osborne's publishing venture was due to him doing the right thing at just the right time. And now he has founded a new venture, the Osborne Computer Corporation, and introduced a new computer, the Osborne 1. As it is based on comparatively old technology (ie the Z80 and 5¼" floppy discs) and with the flood of new 16-bit machines just about to start, the question must be — has Osborne got his timing right this time? For if the machine is to be a success, it has

to fill a gap in the market no one else has spotted.

An Overview

The specification of the Osborne 1 is that of a fairly standard mid-range computer system — Z80 CPU, 64K of RAM and dual 5¼" discs. What is not standard about the Osborne is the way these fairly standard items have been packaged into a small suitcase-sized unit. Much of the advertising literature shows the machine being carried about as if it were no heavier (and no more exciting?) than a normal briefcase.

In reality the Osborne 1 is a little heavier than a normal briefcase but its size and weight by no means rule out carrying it around with you. I found that the problems started when you try to put it down for a short rest. The bottom of the case



slopes back at about five degrees, which is ideal when it is being used as the keyboard (see later) but as a base for the whole machine it produces an unpleasant tilt.

Another problem with carrying the machine around with you is the 13 A plug. On top of the case next to the carrying handle is a small recess covered by a piece of metal held in place by 'Velcro'-type strips of cloth. In the States this recess contains the mains lead *and* the smallest 110 V three-pin plug. In the UK, however, things don't work quite so well — our 240 V three-pin plug is much too big to fit inside this recess and the only sensible thing to do is to leave it hanging outside. The trouble with this solution is the Velcro strips are not strong enough to hold the cover in place if the plug catches on anything. In fact, on several occasions when I was carrying the Osborne 1 about, the cover jumped off without any obvious provocation. So, if you want to avoid the embarrassment of replacing the mains cable and picking up the cover in the street, you'll have to find some other method of holding the lead in place. **(It appears that this problem will be removed by the introduction of an IEC plug/socket combination which will make the power lead removable. Ed)**

I may, however, have the wrong idea of how the Osborne is supposed to get from one place to another. The advertising literature says 'Case — The plastic case snaps together to form a weatherproof package which fits underneath the standard airline seat'. I have not had the courage to test the weatherproof part of the claim and as the complimentary airline tickets haven't arrived yet, I cannot comment on the second claim!

When you have carried the Osborne to its destination then unpacking it ready for use is very easy. Unclipping the bottom of the machine reveals the disc drives, TV screen, sockets and controls. The bottom transforms itself into a full sized keyboard and optional prop for the front of the machine. All you have to do from this point to be up and running CP/M is to plug the machine in, switch on and place the operating system disc in drive A!

There are two slots in the front of the machine, one under each disc drive, which the advertising literature suggests can be used for storing up to 25 diskettes. If you follow this suggestion you don't have to carry *another* briefcase contain-



ing diskettes! However, I'm not sure how wise it would be to leave diskettes in the storage slots when the machine was in use simply because of the risk of stray magnetic fields from the disc drives or elsewhere (especially in view of the lack of shielding — see later) causing disc errors.

Once you've set the system up and are using an applications package or whatever, the only real difference between the Osborne 1 and any other computer is the screen size. The Osborne 1 has a 5" display mounted between the disc drives, and although this gives a sharp and stable image, the actual size of each letter is *very* small indeed. Obviously on a 5" screen there is no way you can achieve a standard commercial 24 lines of 80 characters which is more than I would have thought possible on so small a screen. This is such an important design difference that before you decide on an Osborne 1, it is imperative you check that the small screen size is acceptable to you — it would be a shame to own a machine which did everything right except let you see the answers! **(The current brochures indicate that an external 12" monitor is available. Although we were given one for photography we now understand this product has been withdrawn from the UK market. The replacement will be an adaptor to allow the Osborne to connect to a standard monitor or TV set which will make it much more 'portable' — with the special monitor, you had to carry that round as well! Ed)**

Another side-effect of the small screen is that although *you* may be able to work with the machine, any

Above: The keyboard is encased in the lid of the carrying case and can be completely detached. Nothing terribly special here as far as extra keys are concerned.

Right: The case leans at an alarming angle due to the sloped keyboard enclosure but is not too unstable. The mains lead cover is one of the weaker design features.

Top right: Close up on the front panel reveals the generous provision of I/O sockets. The two deep slots are for disc storage but this is not recommended as there is little shielding provided from the power supply.

ideas that you (or the Osborne Computer Company) may have about using it for business demonstrations, sales pitches, etc are going to be a little more difficult than with a conventional machine. The fanciful scene of someone walking into an office carrying an Osborne 1, setting it up and amazing the boss with how fast all the information is available from the machine is more likely to end in an argument about what information was actually on the screen!

Seriously though, the difficulties of showing other people what's being displayed on such a small screen should be kept in mind when evaluating the Osborne 1. Also, I can't really recommend it for long word processing sessions. You might be willing to tolerate the small character size but remember, you are enthusiastic about computers (you bought one didn't you) but this is not the natural state of the rest of the population — so have a care

OSBORNE REVIEWED



when asking anyone else to word process on your behalf.

Apart from the small character size, there is also the problem that most commercial applications packages expect to find a screen size at least 24 lines by 80 characters. The result of running such a package on a smaller screen is that all the nice formatting and layout which took the programmer so long to do is destroyed. However, the Osborne 1 avoids this problem by using the screen display as no more than a 'window' onto a much larger internal screen. The internal screen is 32 rows by 128 characters wide — an exceptionally large display for a micro. You can move the smaller window around the big display using the normal editing keys. So if a program produces an output with a long line length, you can see all of it by moving the display to the right and left as required. Similarly, you can move the window up and down.

There is also the option of having the window move automatically when you are typing in. If you move the cursor to a position off the edge of the displayed portion of the internal screen, the window is automatically moved allowing you to see what you are typing.

There is no doubt everything possible has been done to overcome the problems of a small screen but it is still a restriction. You could get over the small character size by using an external monitor but there appears to be no simple way of increasing the number of characters displayed on a line.

In most other respects the Osborne 1 behaves much like any other CP/M-based machine. Some notable good points are: the provision of programmable function keys; the provision (as standard) of a serial and an IEEE-488/Centronics interface; and some extra software to make CP/M more bearable! The keyboard is a good quality one with

a keypad to the right, auto repeat on all keys and an alpha lock. The keyboard is connected to the rest of the machine by a short ribbon cable so although it is detached, the amount of movement is limited.

The discs hold a total of 102K each, so you don't have that much to play with after the systems software has taken its share. I would describe 100K as workable but not generous! The advantage to be gained from this low amount of disc storage includes reduced cost and, to a small extent, increased reliability.

Technical Details

The Osborne 1 measures 12" high by 19.5" wide by 8.5" deep when closed and weighs a very modest 24lb! Its case is made from a thin cream-coloured plastic and comes in two parts — the keyboard and the main machine.

Access to the inside of the machine is via the front panel. If this is removed, the way the various components — disc drives, video monitor, etc — are supported and joined together can be seen. A thick strip of black plastic is shaped to hold the disc drives and the monitor at the correct height and the printed circuit board holding nearly all of the electronics is fixed underneath.

Undoing two screws on either side of the case allows the entire assembly to slide out. As soon as the hardware is out of its case it all seems very flimsy and mechanically weak. This is because the case and the internal hardware support each other. The case stops the internal hardware from moving and vice versa. So although the internal hardware can be removed very easily for servicing, it must be handled with care to avoid damage to the main PCB.

The disc drives to either side of the video monitor appear to be completely enclosed by aluminium shielding but in fact, the bottom is unshielded. The purpose of the shielding is a little unclear but it is probably to reduce the effect of the drive motors on the monitor's picture quality. The drives themselves are (in the review model at least) MPI model 51s. As I have no long-term experience of this make, I cannot comment on its reliability but the quality of manufacture seems high. A steel belt is used to position the head and the electronics looks simple and well produced. After comparing the speed of file access with that of other micros I would also think that the head step time is

smaller than average — giving the Osborne 1 a slight speed advantage on disc operations.

The video monitor is a standard (Japanese) unit and, as mentioned earlier, the picture quality is very good indeed. On the review model however, the contrast was always at MAX and there was very little leeway on the brilliance control.

The power supply is mounted on its own PCB to the rear of the main PCB. From a brief examination it is almost certainly a switched mode supply. There is no large power transformer in the Osborne 1 and hence less weight and less heat. There is little ventilation provided but what there is seems adequate.

The main PCB contains the rest of the electronics, the CPU, RAM, ROM, I/O chips and floppy disc controller. The quality of construction is good although the PCB is a little on the thin side for a board of this size and I would like to have seen it better supported. The overall layout is professional but there are plenty of very thin copper tracks everywhere which might prove difficult if a chip had to be replaced. But these are minor points. There is no sign of any last-minute modifications by way of cut copper tracks or jumper wires.

On the far right of the main PCB there are four rows of eight 4116 dynamic RAM chips forming the 64K of main memory. Sitting a little to the left of the main memory block is a single 4116 all on its own. This is the 4K by 1 bit video attribute memory which lives in Memory Bank Three, but more of this later. Moving across to the middle of the board we find two socketed EPROMs. The first is a 2K 2716 used as the character generator; this allows customised character sets to be generated. The second is a 4K 2732 holding the system program. The Z80A in the middle of the board is also socketed and is a double speed (4 MHz) device.

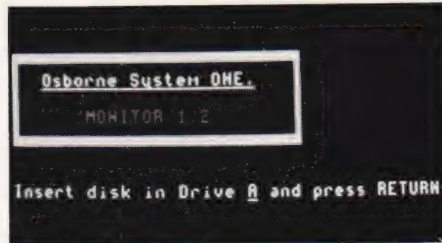
The only real surprise in the Osborne's hardware is found when the other big chips in the system are examined. Three I/O chips made by Motorola are used in preference to the more usual Intel or Zilog parts. There is a sort of unwritten (and unnecessary) rule that you don't mix Intel/Zilog systems with Motorola parts. The reason is that 8080/Z80 programmers are used to the INP/OUT instruction and Motorola I/O chips are all memory mapped.

With 64K of main memory there isn't any address space left over to allocate to I/O ports. The solution

Right: The somewhat complicated memory map. See the text for further details.

Far right: The Osborne revealed. The internal construction is certainly not one of the best seen!

Below: The welcoming message on power-up. The only problem is that the drives aren't labelled!

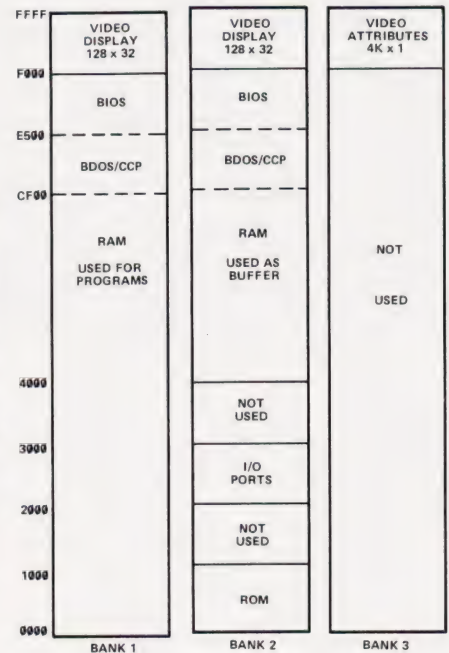


used by the Osborne 1 is to put the I/O ports into a second memory bank. This, at first sight, seems like a very reasonable solution, but the trouble with bank switching is that it is a slow and clumsy way of increasing address space. Both the Z80 and the 8080 have an extra 256 bytes of address space available via the INP/OUT instruction pair and it would have been more sensible to place the Motorola I/O chips as I/O ports. The only minor disadvantage of doing this would have been the restriction in the range of instructions to access the data and control registers. This change wouldn't have got rid of Memory Bank Two altogether because the system EPROM lives there, but it would have allowed the I/O chips to be accessed from any memory bank.

The actual I/O chips used are two 6821 PIAs — one is used for the IEEE-488/Centronics interface and the other is used to control the video display and one 6850 ACIA (used to provide the RS 232 serial interface). The only other large chip in the machine is a 1793 disc controller and the same comments concerning memory mapping can be applied to this device.

The absence of any mention of a large chip CRT controller should have alerted you to the fact that the Osborne 1 uses standard TTL chips to generate the video signal from the top 4K of main memory. Not very much information is available about how this is done or what the 6821 PIA has to do with it all, but it would be a good guess to say the video display was carried out in between Z80 memory accesses and that the PIA has something to do with the area of memory actually displayed. The character generator includes 32 graphics characters but as these have been assigned the same ASCII

MEMORY MAP



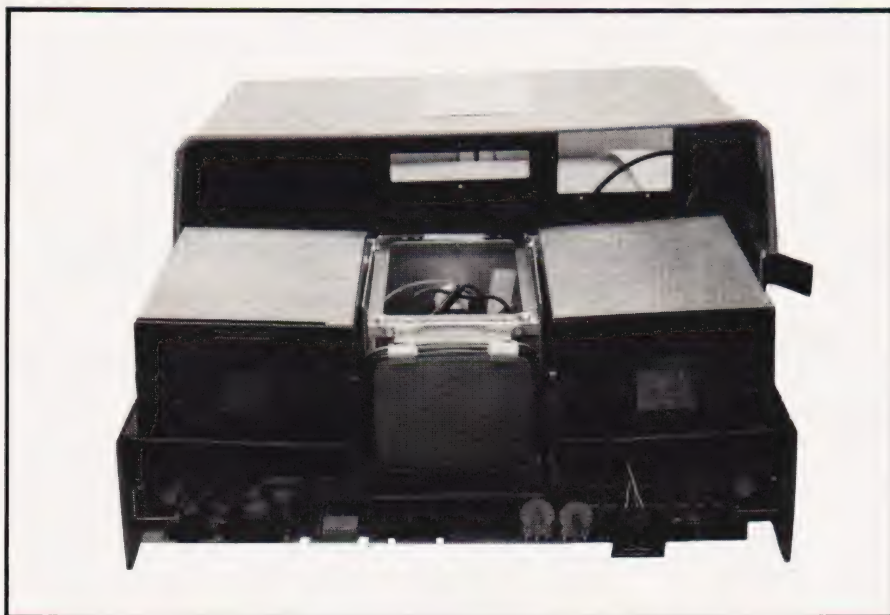
codes as the cursor controls it is only possible to go in for moving graphics from assembly language. There is also a half brightness display mode which can be switched on by setting the appropriate bit in the video attribute memory in Bank Three.

The final I/O device is the keyboard and this too avoids the use of a large chip. Instead, the encoding is done by software and there are eight memory locations used to show which keys are pressed.

The Memory Map

The Osborne 1's memory map is quite complicated for what is otherwise a simple computer! As has already been mentioned, there are three memory banks. The first is simply 64K of dynamic RAM used for CP/M user programs and the 4K video display. As CP/M uses about 18K, user programs have 52K all to themselves — an unusually large amount of free RAM for a system using memory mapped video. The price paid for this free memory is that the system ROM is located in a second memory bank along with all the I/O devices. Switching between memory banks is carried out by outputting to an I/O port and writing to a fixed memory location. As two operations are required, switching is not as fast as it might be. The memory from \$4000 upward is shared by Bank One and Bank Two so you have to be careful when us-

OSBORNE REVIEWED



ing the memory from one in case it is already in use from the other.

There is an obvious problem using the disc which is caused by this memory arrangement. Suppose you have a program running in the first 16K of memory which wants to read a record from the disc. It calls CP/M to look after its request and CP/M switches to Bank Two to gain access to the disc controller. CP/M is still present in Bank Two because it uses memory above \$4000 and thus can send the necessary commands to the disc controller to read the record. The program that requested the data isn't so lucky. It lives below \$4000 so it is *not* present in Bank Two and CP/M cannot transfer data directly to it! What CP/M has to do is first read the data to a buffer high in memory then switch back to Bank One and move the data down to where it is required. The reverse process occurs in a program trying to write data from a buffer (FCB in CP/M terminology) located below \$4000.

The transfer buffer is reserved as part of the Osborne CP/M implementation and the user need not worry about it, but its use does slow things down just a little.

The only other detail about the memory map is that there is a third bank. This bank contains only a 4K by 1 bit video attribute memory which sets the high or low brightness display mode for any character stored in the corresponding address in Banks One and Two.

Free Software!

The Osborne 1 is a CP/M machine and that should tell you a lot about its software. Either you like

CP/M or you don't, but there is no avoiding the fact that CP/M is an industry 'standard' operating system. The Osborne is fairly unique in including a range of system and applications software in its price. As well as CP/M you get Wordstar and Mailmerge, Supercalc, CBASIC and MBASIC. The inclusion of a word processor and a business calculator indicate the sort of use the Osborne 1 is intended for. The provision of MBASIC and CBASIC may seem like overkill but in fact is very sensible. A wide range of business software is available in compiled form running under CBASIC. MBASIC, however, is a fast easy-to-use interpreter suitable for program development.

In addition to these large items of software there is also a HELP program to teach you some simple things about the machine, a disc copying program, a disc formatting program, a setup program to configure the machine and an extended directory command. All of these are useful and make life with CP/M a little more bearable.

Documentation

With Osborne's track record in publishing, you would expect the manual accompanying his first computer to be good. It is! (By the standards of other computer manuals, that is.) The ring-bound manual includes a 'getting started section' and something readable on each of the supplied programs. There is always room for improvement and more information, indeed the manual suggests **The Osborne CP/M User Guide** published by Osborne/McGraw-Hill as a supplement!

Perhaps the entire Osborne publishing output has always been intended as a gigantic computer manual?

Expansion And Development

There is not much that can be done to expand the Osborne 1 in the traditional sense — it already has two disc drives and 64K of memory. There is no expansion bus to be found anywhere on the machine and as the machine has no standard bus structure, you can forget using other peoples' add-ons. In short there is not much you can do to change the Osborne 1 into something else. Having said this it should be pointed out that an IEEE-488 port is standard and should provide at least one way of connecting exotic peripherals such as hard discs, graph plotters, voltmeters, etc.

As for future developments — Osborne promises a 1-2 hour life battery pack and a special modem unit. Future versions of the Osborne 1 are planned to use double density discs and an 80 column screen (sometime in 1982). Certainly the increase to 80 columns would be a major improvement!

Conclusions

The Osborne is certainly capable of being used in ways other machines cannot. It's cheap and portable and I am sure this is enough to make sure that it sells. If it is enough to make it sell as many as Osborne predict it will is another question. If you want an all-in-one business system then there are a number of standard CP/M systems you can choose from — the Super-Brain and the Tandy Model III to name just two — which do not suffer from the tiny screen problem. I am of the opinion that the market for a portable, complete business computer is just not as great as Osborne thinks — but I suppose he has done his market research!

A less obvious area where I think the machine might be popular is as a cheap scientific machine. Because it's small, light and cheap and has an IEEE-488 instrumentation bus I can imagine it being used in a wide range of lab situations where the screen size is of far less importance (see the HP-83/85 systems for evidence of this).

All-in-all, I think the last word should go to the Osborne 1's own manual — 'The hardware of the Osborne 1 is of the plain vanilla variety'.

Superior Systems Ltd. Sheffield

178 West Street, S1 4ET. Tel. (0742) 755005.



APPLE II 48K.....£670.00
DISK DRIVE
WITH CONTROLLER.....£370.00
DISK DRIVE
WITHOUT CONTROLLER...£290.00
BMC 12" GREEN MONITOR
12" GREEN MONITOR....£145.00



SHARP P.O.A.

PC 1211 POCKET COMPUTER.69.50 c
MZ 80K (48K) COMPUTER... P.O.A.
MZ 80B (64K) COMPUTER.. 095.00
DUAL DISK DRIVE.....550.00
P3 PRINTER.....360.00
P4 PRINTER.....745.00
P6 PRINTER.....420.00
SPEED BASIC..... 10.00
MACHINE CODE..... 17.40 b
EDITOR/ASSEMBLER..... 35.00 b
PASCAL INTERPRETER..... 40.00 h
MZ 80K DUST COVER..... 5.00 a
APOLLO WORD PROCESSOR... 24.95 b
CALC II..... 34.50 b
DATA BASE..... 29.50 b
ZEN EDITOR ASSEMBLER... 19.50 a
MACHINE LANGUAGE..... 17.74 b
MZ 80K DUST COVER..... 5.00 a
POSIEDON..... 5.00 a
ADDRESS BOOK..... 5.00 a
MOONLANDER..... 5.00 a
COMBAT..... 5.00 a

Mail Order Accessories

Postage Rates

a.75p b.1.00 c.1.50 d.2.50 e.5.00

BOOKS

(SEND SAE FOR FULL LIST)

BASIC HANDBOOK.....13.95 c
SOFTWARE SECRETS(MZ80K)...7.95 b
APPLE II USER GUIDE.....11.10 c
BASIC BASIC.....8.95 b
PROGRAMMING Z80.....11.95 c
PROGRAMMING 6502.....10.75 c
PROGRAMMING VIDEO GENIE...5.00 b
ZX 81 COMPANION.....7.95 b
ZX 81 POCKET BOOK.....5.95 b
GETTING AQUAINTED ZX81...4.95 b
GETTING AQUAINTED ACORN...7.95 b
HINTS & TIPS ZX81.....4.25 b
CP/M HANDBOOK.....11.50 c
6502 GAMES.....10.25 c
MICROSOFT BASIC.....8.75 b
ATOM BUSINESS.....6.95 a
APPLE PASCAL GAMES.....11.45 b
WORD STAR MADE EASY.....7.60 b

APPLE

VISICALC.....97.50 b
VISIPILOT.....95.00 b
VISITREND/VISIPILOT.....135.00 b
VISIDEX.....105.00 b
CIS COBOL.....475.00 b
MICROMODELLER.....420.00 b
APM.....119.00 b
APPLEWRITER.....39.00 b
MAGIC WINDOW.....79.00 b

VIDEO GENIE

SOUND MOD.....7.50 a
COLOUR MOD.....39.46 b
SYNTHESISER.....45.00 b
DUST COVER.....5.00 a

ALL PRICES EXCLUDE VAT



VIC 20

VIC 20 COMPUTER.....173.90 e
VIC CASSETTE DECK....39.09 d
VIC PRINTER.....200.00
3K RAM CARTRIDGE.....26.04 b
8K RAM CARTRIDGE.....39.09 b
16K RAM CARTRIDGE...65.17 b
JOYSTICK.....6.52 b
PADDLES.....11.74 b
INTRODUCTION TO BASIC
PART I.....13.00 b
VIC GAMES ROM CARTRIDGES
VARIOUS FROM.....17.35 b



VIDEO GENIE

MKI with sound &
lower case.....309.00
MKII
BUSINESS COMPUTER.....309.00
EXPANSION UNIT
WITH 16K ROM.....199.00

ACORN ATOM

ACORN ATOM 8+5
with colour+PSU.....199.00 d
ACORN DISK PACK.....299.00 d
FLOATING POINT ROM...20.00 a
GAMES PACKS 1-10.....10.00each
WORD PACK ROM.....26.00 a
COLOUR ENCODER.....39.00 b
B.B.C. ROM PACK.....PHONE b
MAGIC BOOK.....5.50 c
MATHS PACK.....10.00 a
ATOM CHESS.....10.00 a
ATOM ADVENTURES.....10.00 a

MAIL ORDER FORM

PLEASE SUPPLY..... £.....
..... £.....
..... £.....
..... £.....

ACCESS/BARCLAYCARD/CHEQUE

P&P+V.A.T. £.....



CARD No.....

TOTAL ENCL.£.....

NAME.....

ADDRESS.....

POST CODE.....TEL.....

ZX COMPUTING

Britain's Biggest Magazine For The Sinclair User

Over 100 pages of information and programs for the ZX81 and ZX80 user including a 1K Chess routine!

ZX Computing is a quarterly magazine with over 100 pages of programs, articles, hints and tips for the ZX81 and ZX80. We've put the magazine together with just one aim in mind — to make sure you get the most use and enjoyment out of your Sinclair computer.

In the first issue, as well as a host of 1K and 16K programs (the majority dumped directly onto the printer), we've got two articles to help dispel the mysteries of machine code, a chess routine which takes up just 1K, an explanation of PEEK and POKE, an entire section on business uses of the ZX81 (complete with a program to handle the accounts of up to 100 customers) and a construction article which will show you — even if you've never used a soldering iron before — how to cheaply double the memory on your ZX81.

If you're serious about exploring the full potential of your Sinclair computer, and you want an easy-to-understand series of articles to improve and develop your programming skills, then ZX Computing is for you. Issue one is on sale now.

- **Software Reviews** — which programs are the best buy?
- **Business Routines** — put your ZX to work!
- **Expansion Systems** — how good and how much?
- **Machine Code for ZX81** — secrets revealed at last!
- **DIY Memory Upgrade** — cheap way of adding bytes

SUBSCRIPTION ORDER FORM

Cut out and SEND TO :



513 LONDON ROAD,
THORNTON HEATH,
SURREY,
CR4 6AR.

**POST FREE
SUBSCRIPTION**

Please use **BLOCK CAPITALS** and include post codes.

Name (Mr/Mrs/Miss)

delete accordingly

Address

Signature

Date

Please commence my subscription to ZX Computing with the issue.

SUBSCRIPTION RATES (tick as appropriate)

£7.00 for 4 issues
UK

£1.75 for a single
copy of the issue

I am enclosing my (delete as necessary)
Cheque/Postal Order/International Money
Order for £

(made payable to ASP Ltd)

OR

Debit my Access/Barclaycard*
(*delete as necessary)



Insert card no.

Sinclair ZX81 Personal Comp the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability

With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, and to drive the new ZX Printer.



New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.⁹⁵

Higher specification, lower price – how's it done?

Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification

- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.



Built: £69.⁹⁵

Kit or built – it's up to you!

You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 700 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



uter-



Available now- the ZX Printer for only £59.⁹⁵

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha- numerics and highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further intructions.

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZXPrinter connects to the rear of your computer – using a stackable connector so you can plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

How to order your ZX81

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

BY FREEPOST – use the no-stamp-needed coupon below. You can pay

by cheque, postal order, Access, Barclaycard or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR.

| Qty | Item | Code | Item price £ | Order Total £ |
|-----|---|------|-----------------|---------------------|
| | Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor. | 12 | 49.95 | |
| | Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor. | 11 | 69.95 | |
| | Mains Adaptor(s) (700 mA at 9V DC nominal unregulated). | 10 | 8.95 | |
| | 16K-BYTE RAM pack. | 18 | 29.95 | |
| | Sinclair ZX Printer. | 27 | 59.95 | |
| | 8K BASIC ROM to fit ZX80. | 17 | 19.95 | |
| | Post and Packing. | | | 2.95 |

Please tick if you require a VAT receipt

TOTAL £ _____

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £ _____

*Please charge to my Access/Barclaycard/Trustcard account no. _____

*Please delete/complete as applicable. _____ Please print.

Name: Mr/Mrs/Miss _____

Address: _____

FREEPOST – no stamp needed.

COT 06

sinclair
ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: (0276) 66104 & 21282.

If your micro only squeals when you thump it in frustration then you obviously haven't got a sound board! We examine a dedicated board for the Tangerine system.

Despite the apparent popularity of the range of micros from Tangerine, relatively few companies seem to be offering hardware add-ons. One exception to this state of affairs is the Sound Board from Bulldog Video. The company itself is somewhat of an exception too, being run by a couple of ex-ICL computer staff — the mainframe making good perhaps?

The board is designed to plug directly into the backplane of a rack-based Tangerine system and is fully self-contained. For the price of £45 you get the board with one sound chip (the GI AY-3-8910), a second chip is optional; an on-board amplifier (or you can connect it to your own); facilities for two I/O ports and a set of documentation.

Better Read

Setting up the board could hardly be easier, just open the front of your rack, find a vacant slot on the backplane and plug it in; it's wise to make sure that the power is off when you do this!

Turning to the first of the three booklets, the User Manual, the logical place to start is at the beginning where the new owner is gently led through the procedures involved in generating some simple sounds. Much of the simple programming is given in machine code, but reference is made to BASIC and examples are given together with some useful tables.

The section concludes with some notes on the shape of sound (piano notes are used to illustrate the various sound shapes) and a very useful frequency table.

Although the board is designed in such a way that you can use the two ports as general purpose I/O, there is no documentation on the pin layout of the socket. However, a small amount of detective work with the GI manual on the sound chip and a multimeter produced the results given in Table 1. These ports are accessed through registers 14 and 15 of the sound chip and are TTL compatible; the GI manual is of some help here too.

The two pieces of GI documentation supplied are the

chip manual, useful but all the values are given in Octal; and a data sheet on the device also not particularly useful. One word of warning about the chip manual — the examples given will not work as shown because they are based on a different clock frequency to that used by the Tangerine.

Wired For Sound

The Sound Board is a memory mapped device and is controlled by two addresses, BC00 and BC01 Hex (four if you have the optional second chip). The actual internal functions of the device are selected by 16 internal registers which can be individually updated.

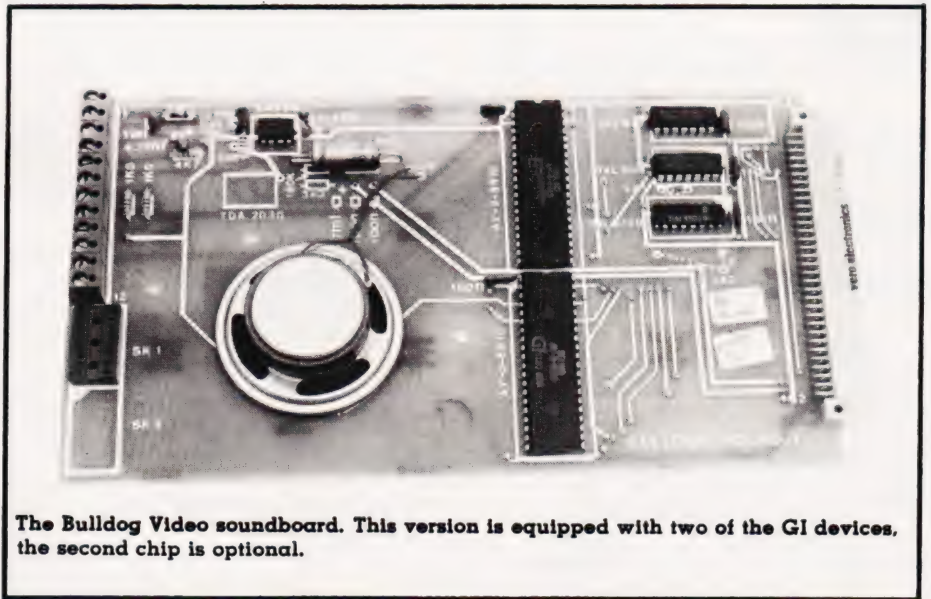
To select any given register, the register number is written to address BC00 Hex (48128) and the new

3) An amplitude controller linked to the envelope generator.

This last feature allows you to turn a single boring tone into something interesting, well almost... there are only eight different envelopes available and the controller acts on all three tones and the white noise. Still, the Sound Board does bark better than it bytes!

To program in the required effect, one simply has to set up certain registers with the necessary values. However, unless you want a continuous tone or sound you may have to alter up to 13 registers for each required note; machine code is likely to prove useful here.

Probably the best way to demonstrate the features is by giving some example programs. The first gives a gunshot each time a key is pressed.



The Bulldog Video soundboard. This version is equipped with two of the GI devices, the second chip is optional.

value is written to address BC01 Hex (48129). Similarly, the contents of any register may be checked by addressing it and reading the value. The second sound chip works in exactly the same way but uses locations BC02 and BC03 Hex.

The three major features of the GI chip are:

- 1) Three tone channels
- 2) A white noise generator able to mix with any of the three tones

```

10 REM ** GUNSHOT
19 REM ** SET ADDRESSES
20 A=48128:B=48129
29 REM ** SELECT FREQUENCY
30 POKE A,6:POKE B,9
39 REM ** NOISE ON ALL CHANNELS
40 POKE A,7:POKE B,7
49 REM ** SELECT ENVELOPE
50 POKE A,8:POKE B,16
60 POKE A,9:POKE B,16
70 POKE A,10:POKE B,16
79 REM ** SELECT ENVELOPE LENGTH
80 POKE A,12:POKE B,4
89 REM ** HIT KEY TO TRIGGER
90 GET AS
100 POKE A,13:POKE B,0
110 GOTO 90
  
```


SPECIAL REPORT

By amending the length of the envelope we can use the same basic functions to generate an explosion.

```

10 REM ** EXPLOSION
19 REM ** SET ADDRESSES
20 A=48128:B=48129
29 REM ** SELECT FREQUENCY
30 POKE A,6:POKE B,11
39 REM ** NOISE ON ALL CHANNELS
40 POKE A,7:POKE B,7
49 REM ** SELECT ENVELOPE
50 POKE A,8:POKE B,16
60 POKE A,9:POKE B,16
70 POKE A,10:POKE B,16
79 REM ** SELECT ENVELOPE LENGTH
80 POKE A,12:POKE B,32
89 REM ** HIT KEY TO TRIGGER
90 GET AS
100 POKE A,13:POKE B,0
110 GOTO 90
    
```

One significant advantage of using a sound generator is that once you have set up the effect it is instantly available. More complicated effects, however, require loops and delays — the next example produces a whistling bomb and could be followed by the explosion just generated.

```

10 REM ** WHISTLING BOMB
19 REM ** SET ADDRESSES
20 A=48128:B=48129
29 REM ** SELECT ONE TONE
30 POKE A,7:POKE B,62
39 REM ** HIT KEY TO TRIGGER
40 GET AS
50 POKE A,8:POKE B,15
60 FOR S=25 TO 200
70 GOSUB 120
80 POKE A,0:POKE B,S
90 NEXT S
100 POKE A,8:POKE B,0
110 GOTO 40
119 REM ** DELAY
120 FOR D=1 TO 5
130 NEXT D
140 RETURN
    
```

In a similar vein this example produces the familiar 'zap' effect for those space games.

```

10 REM ** SPACE ZAP
19 REM ** SET ADDRESSES
20 A=48128:B=48129
29 REM ** SELECT ONE TONE
30 POKE A,7:POKE B,62
39 REM ** HIT KEY TO TRIGGER
40 GET AS
50 POKE A,8:POKE B,15
60 FOR S=10 TO 44
70 POKE A,0:POKE B,S
80 NEXT S
90 POKE A,8:POKE B,0
100 GOTO 40
    
```

As a final example, here is a very simple organ program producing quite pleasing tones as keys 0 to 9 are pressed. It may not exactly be Beethoven but it does illustrate the principle!

```

10 REM ** TAN PIANO
19 REM ** SET ADDRESSES
20 A=48128:B=48129
30 DEF FNA(X)=INT(X/256)
40 DEF FNB(X)=X-FNA(X)*256
50 DIM A(10)
60 DATA 358,318,284,268,240,214,190,180,158,142
70 FOR L=0 TO 9
80 READ A(L)
90 NEXT L
100 POKE A,7:POKE B,248
110 POKE A,8:POKE B,16
120 POKE A,9:POKE B,16
130 POKE A,10:POKE B,16
140 POKE A,11:POKE B,80
150 POKE A,12:POKE B,7
160 GET K
170 K1=A(K):K2=K1/2:K3=K1/4
180 POKE A,0:POKE B,FNB(K1)
190 POKE A,1:POKE B,FNA(K1)
200 POKE A,2:POKE B,FNB(K2)
210 POKE A,3:POKE B,FNA(K2)
220 POKE A,4:POKE B,FNB(K3)
230 POKE A,5:POKE B,FNA(K3)
240 POKE A,13:POKE B,0
250 GOTO 160
    
```

| Pin | Port | Bit |
|-----|------|-----|
| 1 | B | 6 |
| 2 | B | 4 |
| 3 | B | 2 |
| 4 | B | 0 |
| 5 | A | 6 |
| 6 | A | 4 |
| 7 | A | 2 |
| 8 | A | 0 |
| 9 | A | 1 |
| 10 | A | 3 |
| 11 | A | 5 |
| 12 | A | 7 |
| 13 | B | 1 |
| 14 | B | 3 |
| 15 | B | 5 |
| 16 | B | 7 |

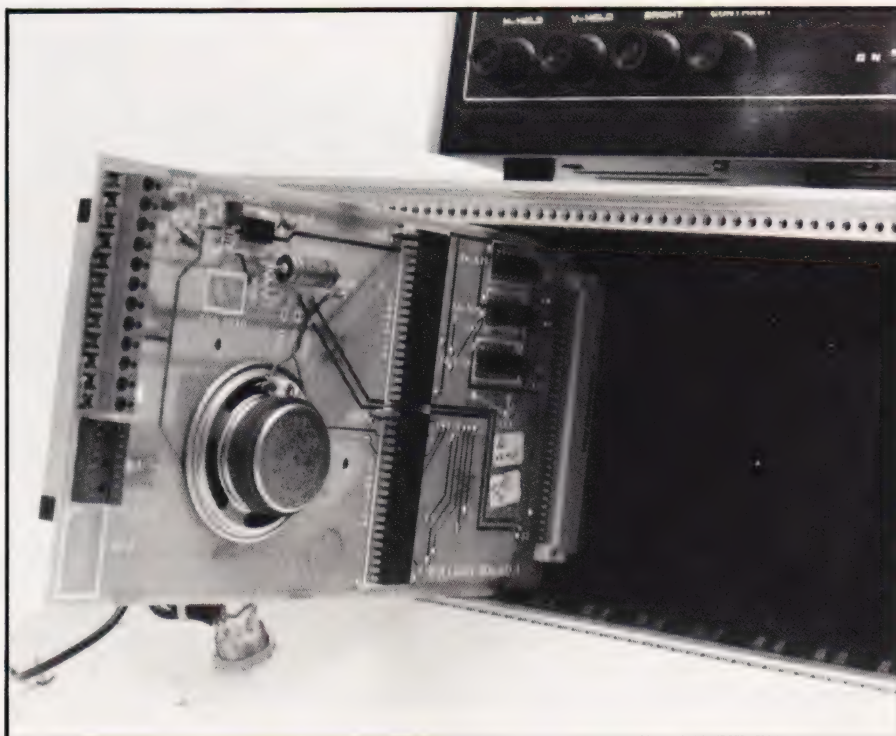
Table 1. The pin connections for the two I/O ports.

Usage and Abusage

One of the major questions about a product such as this is 'what can I do with it?'. Well, you could incorporate it into a serious program to act as a warning device alerting you that some process has failed or that a given number of functions have been performed. It has obvious applications in games programs, especially those of an interactive nature. You could even use it to provide feedback to the user, key clicks in a word processor program for example.

The provision of two I/O ports offers the facility to connect peripheral devices and the status of these could be monitored by the system with the option of audible warnings... perhaps the Bulldog could even become a watchdog?

In summary, therefore, the board is easy to use and simple to install but, as is so often the case, it is let down by inadequate documentation. However, if you want to add sound to your system then the Sound Board still seems to offer value for money.



Fitting it could hardly be easier. Drop the front panel of your rack (this is the Vero alternative) find a free slot and plug it in!

FROM OUR 1982 CATALOGUE

PLUG-IN CHIPS

Command-O £59.95; Rom-X £29/£34; Pic-Chip £45; Superchip £45

WORD PROCESSING

Pagewriter £39; Papermate £35; Wordpro 3 Plus £275; Wordpro 4 Plus £395; 80 £375; Microscript £425; Papermate Plus £45

BUSINESS PROGRAMS

Visicalc £125; FASTER Basic £30; Simplicalc £26/£32

DISK UTILITIES

Disk Merge £15; Disk Append £15; Autorun £10; Master Directory £22; Master Index £12; Disk-O-Pro £59.95; Disk Search 2 £40; Disk Menu £12

FAST SORTS

Speedsort £12; Numsort £12; Tagsort £18; Multisort £25; Supersort £40

TAPE AIDS

Arrow £30; Tape Merge/Append £15; Hi-Save £12

PROGRAMMING AIDS

Block Renummer £15; J-K-L £8; Compactor £15; Basic Edit £6; Flip £12; P.E.P. £25; Graphics Aid £10; Findstring £18; Shrink £5; Screensave £6; Link & Shrink £10; List £10; Instring £10

EXPANSIONS & UPGRADES

Two-Rom Board £20; Two-Plus-Two Board £20; Four-Way Spacemaker £35; 64K Super Pager £75; Basic 4.0 Upgrades £38; Dos 2.1 Upgrades £38; Flip Forty £18; Ram Adaptor £40; 4K Expansion £40

ASSEMBLY LANGUAGE

Mikro Assembler £50; Makro-X £50; Makro Disassembler £25; Makro-XR £60; Supersave £5; Extramem £10; Bytemiser £15; 8K Tim £5; Assembler Pack £75

EDUCATION

Infinite Arithmetic £25; Life £10; Basic Basic £9; Stratholyde Basic £20; Kings & Queens £6; Font £8; Animation £18; Target ABC & Mashier £7; Linear Regression £25; Forth £50; Physics Packs (1-5) £7 each

BOOKS

Pet Revealed £10; Vic Revealed £10; Library of Pet Subroutines £10; Pet Graphics (1 & 2) £10 each; CBM Basic 4.0 Manual £5; CBM Disk Manual £5

ACCESSORIES/SUPPLIES

Spares Kit £25/£30; Green Screen £7.50/£9.50; Cassette Care Kit £7.50; Disk Storage Pages £0.50; Disk Library Cases £2.75; Disk Power-On Error Indicator £17.50; Dustcovers £3.50-£5.75; IEEE Cables (double length) £32; Eprom Programmer £75; Zero Insertion Force Sockets £5.75; Soundbox £22; Verbatim Disks £18 (40 track) £25 (77 track); Printer Ribbons £1.80-£8.50; Paper £18; Labels £4-£8; TV Interface £35

GAMES

Gomoku £8; Lost Valley £14; Treasure Troves (1-3) £9 each; Halls of Death £14; Wizard's Lair £10; Othello £8; Pet Chess £25; Air Attack £5; Nimbo £7

ARCADE GAMES

Super Gloop £8; Cosmic Jailbreak £6; Cosmiads £6; Invaders £6; Meteorites £8; Asteroids £8; Rom Invaders £19.95; Space Rescue £8; Space Ace £14; Space Debris £8; Tanks £8

ADVENTURERS

Hitch-Hikers Guide £16; Goblin Towers £14; Cracks of Doom £14; Catacombs £27; Weird Wood £25; Cornucopia £35

THE ONES THAT GOT AWAY-

Cosmic Aliens £8; Print Using £15

Add VAT to all prices and pre-paid orders. Post Free.

SUPERSOFT

First Floor, 10-14 Canning Road,
Wealdstone, Harrow, Middlesex
Phone: 01-861 1166



MICRODATA

4 GREENBARN WAY, BLACKROD, LANCASHIRE BL6 5TA.
TEL: 0204 694265

TRS80 MODEL I & III AND GENIE

THE CSL PHOTOPEN — a British made Lightpen for the Model I & III TRS80 and Genie. The CSL Photopen is complete with a cassette of four Level Two Basic applications programs and full instructions and programming hints. We even include a 9v battery! The Photopen connects via the cassette recorder. Genie I owners can connect the Photopen to the second cassette port using an external cassette recorder or small amplifier. Four hundred sold!

Price: £14.99 + 50p P&P

PENPACK ONE — a further four programs for your Photopen:

Geography Test — presents a graphics map of the British Isles and tests your knowledge of towns and cities.

Pen Gomoku — play the famous oriental game against your system.

Towers — solve this brain-teasing puzzle with your Photopen.

Penpad — draw on your monitor screen with the Photopen.

Price: £2.50 + 20p P&P

THE TANDYSTIK CONTROLLER — at last a joystick controller for the Model I TRS80! Full instructions and a cassette of three Level Two Basic programs are included. The Tandystik is compatible with most of the Big Five arcade software including Meteor Mission II, Super Nova, Cosmic Fighter, Galaxy Invasion and Attack Force.

Price: £22.50 + 50p P&P

SOFTSTIK — a powerful machine code utility which enables your existing software to work with the Tandystik without any program amendments. Softstik will work with any Basic program which uses either INPUT or INKEY\$ functions and any machine code software which uses the ROM resident keyboard scan.

Price — 16K version on cassette: £9.50 + 50p P&P

— 32/48K version on disk: £11.00 + 50p P&P

THE ACORN ATOM

ATOMSTIK — A joystick controller for the Acorn Atom. The Atomstik attaches to your Atom via the 64-way expansion connector. The Atomstik will work with any memory size and Integer Basic. It requires the VIA. Complete with full instructions and two programs on cassette. Realise the potential of your Atom for interactive games now!

Price — Atomstik: £22.00 + £1.00 P&P

— VIA and Connector (if required): £12.00 + 50p P&P

BBC MICROCOMPUTER

BEEBTAPE — A bi-monthly cassette of ready to run programs for your BBC microcomputer. Available by annual subscription. Write for details.

ACCESS TELEPHONE ORDERS DESPATCHED SAME DAY

— RING ANYTIME



SUSSEX



SHARP MAIN DEALER



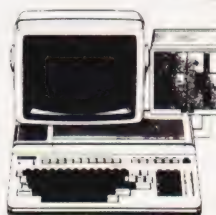
MZ80A

Latest Model
£415.00 + VAT



MZ80B

Our Price
£950 + VAT



PC3201

The Businessman's
Machine
£2,995 + VAT

Buying from a reputable dealer will give you service after sales.
All prices inclusive of delivery.



CROWN BUSINESS CENTRE LTD.

56-58 SOUTH ST., EASTBOURNE. Tel. 639983/20496

SPECIAL
INTRODUCTORY
PRICE — SAVE £10

FOR TRS-80 USERS

Eprom Programmer

The LM124 EPROM PROGRAMMER when used with the Tandy TRS-80 Model I 16K Level II Microcomputer will program the following single rail eproms:

| | |
|-------|------------------------|
| Intel | 2758, 2716, 2732 |
| Texas | 2758, 2508, 2516, 2532 |

and other manufacturers compatible types

- The LM124 is a port based system having one IN port and three OUT ports
- It is fitted with a quality Zero Insertion Force socket and has a complete on-board power supply unit
- Completely enclosed in a robust plastics case
- No personality modules required
- All eprom types may be fully programmed in one pass
- Full operating instructions in comprehensive 20-page Users Manual
- Requires Tandy Interface Cable.

VIDEO GENIE and Model III adaptors available soon!

LM124 SOFTWARE FEATURES INCLUDE

- **Powerful Editing Facilities** 256-byte page display, single interpage keystroke, full cursor control, byte and nibble-wise movements, flashing cursor
- **Compatible with EDTASM** Loads object code assembled by TRS-80 Editor/Assembler EDTASM, uses EDTASM's command syntax.
- **Comprehensive Command List** BURN, COPY, EXIT, FILL, LOAD, MEMORY, NEW, PAGE, READ, SAVE, TEST, ZERO.
- **Comprehensive Error Messages** Programming Error, Verification Error, Checksum Bad, Outside Range, Bad Parameters, Syntax Error, Illegal Command.
- **Plus** Graphical display during Burn, Automatic Verify, Burn Pause/Continue, Hard Copy.
- **SPECIAL INTRODUCTORY PRICE £57.50** including postage and packing. Valid until 12.6.82. The Users Manual is also available separately at a cost of £2.20 including postage.



**LANDER
MICROSYSTEMS**

Telephone
Romford 26325

32 Clockhouse Lane, Collier Row, Romford, Essex

HENRY'S COMPUTER KIT DIVISION

404 EDGWARE RD. LONDON W2 1ED
TEL: 01-402 6822

E•TANGERINE•TANGERINE•TAN MICROTAN 65

Electronic Today International held a mammoth survey of kits: the result
COMPUTER CLASS!
Microtan 65 WINS

Microtan 65 is the most advanced, powerful, expandable microcomputer available — it also happens to be the most cost effective.



You may deduct
**£10 FROM
MICROTAN 65
kits
and assembled
units
listed here
Only from us.
DELIVERY
EX-STOCK
POST PAID
Limited quantity
available.**

MICROTAN 65 CONTENTS

High quality, plated thru hole printed circuit board, solder resist and silk screen component identifications. 6502 microprocessor. 1K monitor TANBUG. Now with 'V' Bug. 1K RAM for user programme, stack and display memory. VDU alphanumeric display of 16 rows by 32 characters. MICROTAN 65 system file binder. 136 page, bound, users hardware software manual with constructional details and sample programmes. Logic and discrete components to fully expand MICROTAN 65.

The MICROTAN 65 kit has won widespread acclaim for its superb presentation. We pay attention to detail.

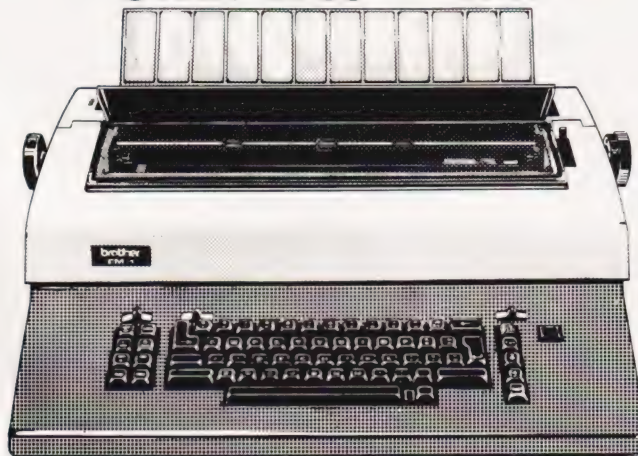
KIT FORM £69.00 + £10.35 V.A.T. total
£79.35

MICROTAN 65 assembled and tested. Specification as above but assembled and fully bench tested by ourselves.

£79.00 + £11.85 V.A.T., Total £90.85.

THE FINEST PRINTER/TYPEWRITER MONEY CAN BUY.

THE CROWN RANIER ONLY £795 + VAT



We offer a heavy duty daisy wheel printer/typewriter at the flick of a switch. This machine has the very latest linear motor — no cables or belts to break, stretch or wear. Beware of light weight, low cost machines, these can never give long term reliable service. THIS MACHINE WILL!!

Centronics or IEEE interface. Interchangeable daisy wheels — variable pitch — whole line memory. Uses standard type IBM ribbons and lift off correctors. Perfection as a typewriter (used by local authorities). Perfection as a printer.

Ask your local computer or office equipment dealer for further information. EXSTOCK DELIVERY

SOLE UK AGENT. TRADE ENQUIRIES INVITED.



CROWN BUSINESS CENTRE
EASTBOURNE, 56-58 SOUTH ST.,
SUSSEX. (0323) 639983.

**NEW SHAPE
COMMAND**

CORN ATOM

NEW 4K EPROM PLUGS STRAIGHT
INTO UTILITY SOCKET FLASHING CURSOR
1200,600,300 BAUD CASSETTE OPERATING SYSTEM.
VISIBLE AND AUDIBLE INDICATION OF LOAD & SAVE.

Draw complex graphic shapes with one instruction
using our special 'SHAPE' command

NEW COMMANDS

- SHAPE N X,Y** — draw shape number N at X,Y
- BLOCK** — draw block of any size, any graphic mode
- POINT** — test if graphic point set or clear
- FIND** — print lines which contain a given string
- KEY** — scans keyboard for use in real time games
- ZERO** — zero all basic variables
- SCREEN** — set cursor to screen location (0 to 511)
- STOP** — debugging program command
- POP** — allows unlimited jumps out of a sub.
- MC** — monitor — memory change, Hex & textdump
- RENUMBER** — including GOTOs and GOSUBs
- AUTO** — automatic line numbering
- DELETE** — delete block of program lines
- VERIFY** — verify programs after recording on tape
- PACK** — removes non significant spaces
- tone** — sound a note of any duration and tone

**PLUS: READ,DATA,RESTORE,BSAVE,APPEND,TAPE...
AND MORE**

Fits any size memory Atom

Full Documentation included

EXTRA SPECIAL PRICE £15.95 ALL INCLUSIVE

**Ross
Software**

RUSH YOUR ORDER TO: Ross Software
44 Premier Avenue, Grays, Essex RM16 2SD
Send S.A.E. for details.

ANDREW DEVELOPMENTS

93 BEACONSFIELD VILLAS, PRESTON PARK,
BRIGHTON. Tel. (0273) 564629).

ZX81 2 x 8 Bit Parallel Interface

Features 16 user programmable input/output lines
under your control. Use it to control

- Heating
- Lighting
- School Experiments
- Robots
- Printer

Many more applications. Example software and circuit
suggestions supplied with each board.

APPLE A/D Converter

Reads 8 analogue channels with 8 bit resolution.
Bipolar inputs. Turns your Apple into an eight channel
data logger/chart recorder/oscilloscope.

Supplied with notes and software (Specify DOS 3.2,
3.3 or Cassette), in an attractive ring binder

APPLE Universal Printer Interface/Real Time Clock

Clock gives time/date to tenth sec. and interrupt.
Interface includes software to drive most common
printers. (Can also be used as 8 Bit port.)

ZX81 Card 16.50 + 2.48 V.A.T. + 30p p. & p.
APPLE A/D Converter 49.95 + 7.49 V.A.T. + 1.00
p. & p.
APPLE Universal Printer Interface/Real Time Clock
79.00 + 11.85 V.A.T. + 1.00 p. & p.

ARE YOU A ZX81 USER WHO'S NOT PLAYING GAMES?

PLAYING GAMES?

ECR 81 DATA RECORDER SAVES AND LOADS YOUR PROGRAMS EVERY TIME!

The ECR81 Enhanced Certified Recorder from MONOLITH is a
major advancement in cassette recorder technology which minimises
the problems associated with standard audio recorders. The unit is a
high reliability program store for ZX computers based on a modified,
proven cassette mechanism. The two sections of data recording
circuitry automatically ensure precise levels are written onto the
tape and that optimised signals are received by the computer.

**THE ECR81 IS NOT SUITABLE FOR AUDIO REPRODUCTION
NO MANUAL VOLUME OR TONE CONTROL ADJUSTMENT PROVIDED**

To: MONOLITH ELECTRONICS CO. LTD., 5/7 CHURCH STREET, CREWKERNE, SOMERSET

| Please supply me with: | Price | Total |
|--|------------------|-------|
| ----- (Qty.) Monolith ECR 81 Enhanced Certified Recorder(s) to be used with my ZX81 | £47.50 (Each) | |
| I also enclose postage & packing per recorder | £2.50 | |

Please print

Prices include VAT

£

Name: Mr/Mrs/Miss.

Address



£47.50
Including VAT.
complete

- Each ECR81 comes complete with its own individual certification tape, tested and serial numbered to prove your machine reliability.
- Mains Operation only.
- Mains & DIN connector leads provided.
- Certification of tape head alignment - height and azimuth.
- Certified tape tension, torque and speed.
- Fast forward and rewind tape search controls.

The ECR81 is also suitable for Sinclair ZX80

- Please allow up to 28 days delivery. ● The ECR81 is backed by our 14 day money-back option.

MONOLITH
electronic products

Telephone: Crewkerne 0460 74321 Telex: 46306

PROGRAM PROTECTION

Paul Hodgkinson

This simple method of protecting your programs from being copied may not be the most elaborate but it can certainly cause considerable frustration to the unauthorised user.

Despite recent advances in microcomputer technology, unauthorised copying of programs remains a seemingly insoluble problem. Most existing methods attempt to prevent a return to the command level thus making copying impossible. This is achieved by amending appropriate addresses in the machine by using POKE. Such systems are, of course, ineffective if the program is not run.

This technique, although not a complete solution, has certain attributes which make it very effective. No attempt is made to prevent a copy being made and this can be verified against the original; if the copy is loaded into the PET, it will run and the listing is identical. However, when the user returns at a later date with the copy and attempts to use it, the copy appears corrupted and will not run.

Creating Protected Copies

The technique listed here is suitable for use with 16K and 32K PETs.

1) Append an additional statement to the program to be protected. List the program and insert SYS 1000 near the beginning. Remember not to append it to a line which already contains a REMark statement because the entire content of a line following REM is ignored. Decimal 1000 is particularly suitable because it implies a small machine code subroutine resident in the second cassette buffer.

2) Determine the top of BASIC text. At this stage it is necessary to determine how long the program is. This is done by examining the pointer to the start of variables. Variables are stored in the RAM immediately following the BASIC text. Enter:

```
PRINT PEEK(43):PRINT PEEK(42)
```

When Return is pressed two figures will appear:

```
4  
104
```

These are the high order byte and the low order byte, expressed in decimal, of the pointer to the start of variables. They must now be converted to a four-digit hexadecimal

number. Remember Hex is base 16 and the figures 10 to 15 are substituted by A to F. For example, decimal 255 becomes FF and the example above, therefore, becomes 0468 Hex.

3) Enter the Machine Language Monitor (TIM). TIM is resident in 16K and 32K PETs but a cassette version is required for 8K models. Enter:

```
SYS 1024
```

When Return is pressed the monitor is entered and a display of registers will appear.

4) Display the contents of decimal 1000 (Hex 03E8). After the full stop, type:

```
M 03E8,03EF
```

When Return is pressed, the contents of the bytes from 03E8 Hex to 03EF Hex will be displayed on a single line as two-digit hexadecimal numbers starting with 03E8 Hex. If a '?' appears, the space between the M and the 0 of 03E8 Hex has been omitted. Although this is the standard format for using the monitor it seems designed to mislead! It is not the space that is important, any character can replace the space or comma without affecting the operation of the monitor.

5) Place the 6502 op-code 'Return from subroutine' in decimal 1000 (hexadecimal 03E8). Move the cursor up to the 03E8 Hex in front of the line of bytes previously displayed. Move across to the first two digit number, overtype it with 60 and press Return.

6) Save the program using the Machine Language Monitor (TIM). TIM is used because the start and end address can be specified and it is necessary to save the op-code in 03E8 Hex with the BASIC text. After the full stop, enter:

```
S "TITLE",01,03E8,0458
```

Where 'TITLE' is the program name, 01 is the device number to which the save is made (in this case the first cassette), 03E8 Hex is the start address and the last hexadecimal number (in this case 0468 Hex) is the figure previously calculated to be

the top of BASIC text. The familiar 'PRESS PLAY AND RECORD ON TAPE 1' should appear when Return is pressed. Operate the cassette deck as normal. If '?' appears you have probably forgotten the space after the S.

7) Exit from the Machine Language Monitor is done by typing X and pressing Return. You now have a protected copy. The copy will load in the usual way because LOAD detects the start address placed on the tape header by TIM.

How It Works

The protected copy contains the contents of the bytes from 03E8 Hex upwards as well as the BASIC text. When the program is LOAded and RUN, SYS 1000 passes control to decimal 1000 (03E8 Hex). The op-code 60(RTS) immediately passes control back to BASIC and the program RUNs as normal.

If an unauthorised copy is made using SAVE, only the BASIC text from 1024 upwards is recorded — the vital op-code in 03E8 Hex is not included. If the unauthorised copy is loaded to check it is correct, it will run as expected. This is because 03E8 Hex is in a protected area of RAM and is unaffected by command level instructions. The op-code from the original copy will still remain to pass control back to BASIC, providing that the PET has not been switched off or the second cassette buffer used in the interim period.

When the user returns at a later date, the copy will LOAD but any attempt to RUN will cause the monitor to be entered followed by a break or a crash depending on the contents of 03E8 Hex at the time.

Conclusion

This technique offers a more subtle approach to program protection and attempts to confuse the copier rather than throw down a blatant challenge to defeat the protection.

It is readily adapted to operate on other microcomputers which have a flexible Cassette Operating System. Most manufacturers leave bytes unused in the reserved area of RAM.



OSBO

Dual floppy disk drives. Two 5¼" floppy disk drives provide 100,000 characters each of data storage, or about 60 pages of typed, doublespaced text.

Diskette storage. The floppy diskettes can be removed, providing infinite permanent information storage. Two compartments provide storage for up to 25 diskettes.

RS-232C Interface. Enables the OSBORNE 1 to connect with serial printers, or other devices using this popular industry-standard interface.

IEEE 488 Interface. Connects the OSBORNE 1 to the standard instrumentation bus, for data communication with test instruments.

Osborne 1.
It doesn't need a room of its own.
Or even a desk of its own.
With its optional battery pack, in fact, it doesn't need mains electricity for up to two hours.
It's - as you can see - portable.
Weighing under 24lb in its weatherproof case, it can be carried in one hand. Or in your car. Or tucked under an airline seat.
But its performance is equal to, often better than, small business computers several times as big and twice as expensive.
The Osborne 1 will achieve in seconds commercial, engineering or scientific calculations which, without a computer, would take days.
And store a whole library of data for instant retrieval and use any time.

Connected to a printer, it will operate as a word processor and produce letters, documents, reports - anything you want word- (and figure-) perfect.

And carry out financial planning, too, using an electronic spreadsheet, providing fast, accurate cash flow forecasts and instant answers to those important 'what if' questions.

You can see an Osborne 1 - and try it out - at any of the dealers listed below.
And then happily walk away with it.

For £1,250* the only personal business com

*excluding VAT.

See the Osborne 1 at any of these authorised dealers:

LONDON
Adda Computers Ltd, Mercury House, Hangar Green, Ealing, London W5 3BA. Tel: (01) 997 6666

Business Computers (Systems) PLC, The Pagoda, Theobald Street, Borhamwood, Herts WD6 4RT. Tel: (01) 207 3344

Byteshop Computerland, 324 Euston Road, London NW1. Tel: (01) 387 0505

Digitus Limited, 10/14 Bedford Street, Covent Garden, London WC2E 9HE. Tel: (01) 379 6968

Equinox Computer Systems Ltd, Kieaman House, 16 Anning Street, New Inn Yard, London EC2A 3HB. Tel: (01) 739 2387/729 4460

Lion Microcomputers, Lion House, 227 Tottenham Court Road, London W1. Tel: (01) 637 8760

Microcomputers at Laskys, 42 Tottenham Court Road, London W1 9RD. Tel: (01) 636 0845

O Computers, 108 Rochester Row, London SW1P 1JP. Tel: (01) 630 5449
Star Computer Group PLC, 64 Great Eastern Street, London EC2A 3QR. Tel: (01) 739 7633
Subscription Services, 70 Warren Street, London W1P 5PA. Tel: (01) 389 2663

The Xerox Store, 84 Piccadilly, London W1V 9HE. Tel: (01) 629 0694
77 High Holborn, London WC1V 6LS. Tel: (01) 242 9596
110 Moorgate, London EC2M 6SU. Tel: (01) 588 1531

BELFAST
Northern Ireland Business Systems Ltd, 7/9 Botanic Avenue, Belfast BT7 1JH. Tel: (0232) 48340

BIRMINGHAM
Byteshop Computerland, 94/96 Hurst Street, Birmingham B5 4TD. Tel: (021) 622 7149

Microcomputers at Laskys, 19/21 Corporation Street, Birmingham B2 4LP. Tel: (021) 632 6303

BRISTOL
*Microcomputers at Laskys, 16/20 Penn Street, Bristol BS1 3AN. Tel: (0272) 20421

CAMBRIDGE
Cambridge Computer Store, 1 Emmanuel Street, Cambridge CB1 1NE. Tel: (0233) 65334/5

CHESTER
Microcomputers at Laskys, The Forum, Northgate Street, Chester CH1 2BZ. Tel: (0244) 317667

DERBY
Datron Micro Centre, Duckworth Square, Derby DE1 1JZ. Tel: (0322) 380085

EDINBURGH
Microcomputers at Laskys, 4 St James Centre, Edinburgh EH1 3SR. Tel: (031) 556 2914

GLASGOW
Byteshop Computerland, Magnol House, 61 Waterloo Street, Glasgow G2 7BP. Tel: (041) 221 7409
Microcomputers at Laskys, 22/24 West Nile Street, Glasgow G7 2PF. Tel: (041) 226 3349

GUILDFORD
Systematic Business Computers, Brabour House, 64 Portsmouth Road, Guildford, Surrey GU2 5DU. Tel: (0483) 32666

LIVERPOOL
Microcomputers at Laskys, 14 Castle Street, Liverpool L2 0TA. Tel: (051) 227 2535

MANCHESTER
Byteshop Computerland, 11 Gateway House, Station Approach, Piccadilly, Manchester M1. Tel: (061) 236 4737

Microcomputers at Laskys, 12/14 St Mary's Gate, Market Street, Manchester M1 1PX. Tel: (061) 832 6087

NEWCASTLE
Sage Systems, Hawick Crescent, Newcastle upon Tyne NE6 1AS. Tel: (0632) 761669

NOTTINGHAM
Byteshop Computerland, 92A Upper Parliament Street, Nottingham NG1 6LF. Tel: (0602) 40576

*Microcomputers at Laskys, 1/4 Smithy Row, Nottingham NG1 2DU. Tel: (0602) 415150

PRESTON
Microcomputers at Laskys, 1/4 Guildhall Arcade, Preston PR1 1HR. Tel: (0772) 59264



OSBORNE 1

TM



Internal electronics. Z80A™ CPU, 64K bytes RAM memory (60K available to the programmer, 4K used to run the screen.) System software is held in ROM in a separate address space.

Screen. Clear, 5", 24-row screen displays a 52-character window on a 128-character line with automatic horizontal scrolling.

Monitor Interface. Connects the OSBORNE 1 to any monitor screen.

Keyboard. A standard typewriter keyboard plus numeric, adding-machine keypad for fast entry, and cursor control keys for easy cursor movement.

Case. The plastic case snaps together to form a weatherproof, 24-pound package that fits underneath the standard airline seat.

Standard software

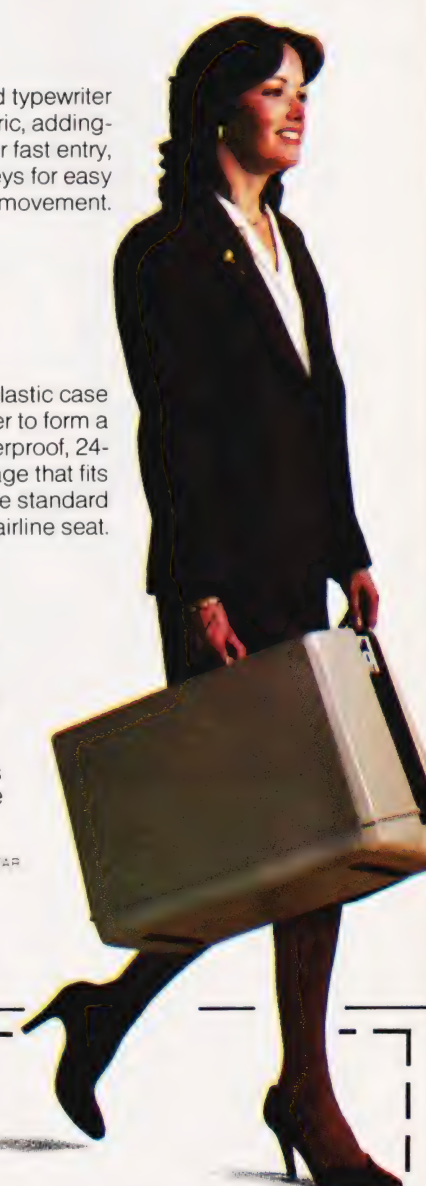
Five outstanding software packages, with a retail value of over £800 are included:

- CP/M® Operating System
- WORDSTAR® with MAIL MERGE®
- SUPERCALC™ ● MBASIC®
- CBASIC®

Optional extras

- Modem cable for use with acoustic couplers for telephone transmission of data
- Battery pack
- Double density disk drives with 200K bytes of storage per drive

Trademarks: SUPERCALC: Sorcim Corporation; Z80A: Zilog Corporation.
Registered Trademarks: OSBORNE 1: Osborne Computer Corporation; CP/M Digital Research; WORDSTAR MAILMERGE: MicroPro International; MBASIC: Microsoft; CBASIC: Compiler Systems, Inc.



puter you can take anywhere.

SHEFFIELD
Datron Micro Centre, 2 Abbeydale Road, Sheffield S7 1FD
Tel: (0742) 585490
Microcomputers at Laskys, 58 Leopold Street, Sheffield
S1 1XZ. Tel: (0753) 76957

SLOUGH
The Xerox Store, 3/4 William Street, Slough, Berkshire
SL1 1XZ. Tel: (0753) 76957

SOUTHAMPTON
Xitan Systems Limited, 23 Cumberland Place,
Southampton SO1 2BB. Tel: (0703) 38740

TORQUAY
Crystal Electronics, 40 Magdalene Road, Torquay, Devon.
Tel: (0805) 22699

For further information and full specification, return the coupon to The Marketing Manager, Osborne Computer Corporation (UK) Ltd, 38 Tanners Drive, Blakelands North, Milton Keynes, Buckinghamshire MK14 5BW. Telephone: 0908 615274. Telex 825220

More information on Osborne 1, please.

Name _____

Address _____

CT6 _____ Tel _____

OSBORNE
COMPUTER CORPORATION (UK) LTD.

* Opening shortly

Make the Most of Your Career in Computing

For an Easy and Inexpensive Way to Keep Up
THE COMPUTER BOOK CLUB
 Books and Services for the Information Processing World

TAKE ANY 3 FOR ONLY £2 EACH
 plus p&p* & SAVE!
WORTH UP TO £50.55
 at publisher's prices

Books shown include:

- 8080/286 Assembly Language (M30 £6.75 pub. edn.)
- COMMUNICATION NETWORKS FOR COMPUTERS (D13 £31.35 pub. edn.)
- Writing Interactive Compilers and Interpreters (B83 £13.05 pub. edn.)
- USING C/P/M A SELF-TEACHING GUIDE (FB7 £5.95 pub. edn.)
- The Codasyl Approach to Data Base Management (O12 £14.30 pub. edn.)
- MODERN MICROPROCESSOR SYSTEM DESIGN (M50 £19.20 pub. edn.)
- THE ART OF SOFTWARE TESTING (M10 £16.25 pub. edn.)
- BUILD PROGRAM TECHNIQUE: Languages (R10 £22.15 pub. edn.)
- PASCAL The Language and its Implementation (B60 £12.50 pub. edn.)
- MANAGING SYSTEMS DEVELOPMENT (K40 £10.75 pub. edn.)
- Structured Programming in BASIC for Science, Business and Education (L40 £8.75 pub. edn.)
- GUIDELINES FOR COMPUTER MANAGERS (N30 £15.00 pub. edn.)
- DATA BASE STRUCTURED TECHNIQUES FOR DESIGN, PERFORMANCE, MANAGEMENT (A12 £22.15 pub. edn.)
- COMPUTER PROGRAMS THAT WORK (K38 £9.45 pub. edn.)

Special offers: "COUNTS AS 2 CHOICES" (for 8080/286, COMMUNICATION NETWORKS, USING C/P/M, BUILD PROGRAM TECHNIQUE, DATA BASE); "SET COUNTS AS ONE" (for COMPUTER PROGRAMS THAT WORK, Structured Programming in BASIC).

Why is the Computer Book Club a great source for top-notch books at surprisingly low prices? Here are five good reasons why:

- **Editorial Quality:** Each month you'll find on offer a range of fine books covering a variety of fields of interest, all carefully reviewed and selected by our own team of experts.
- **Big Savings:** In addition to getting your choice of three books for £2.00 each plus p&p*, membership will entitle you to keep on saving—up to 25% (sometimes even more) off on all books.
- **No Pressure to Buy:** You have both real choice and an easy to handle commitment with The Computer Book Club. We'll send you the Club News monthly—describing the latest selections—but you needn't take any particular book or take one book a month. All we ask is that you take at least four books during your first year of membership.
- **Software Services:** We are polling our membership to find out if we can be of further service in supplying software packages. Your thoughts and needs will also be incorporated in our survey.
- **Added Advantages:** You'll be able to read the Club News at your leisure, make your selection from the comfort of home and have the books you select delivered promptly to your door.

Please accept my application and enrol me as a member of The Computer Book Club. Send me the three book choices whose numbers I have indicated below. (Some more expensive books, as shown above, will count as two choices.) You will charge me a total of £6.00 for my introductory books, plus £1.25 towards postage and packing*. If not completely satisfied I may return the books within 10 days, cancel my membership and owe nothing.

As a member my commitment is to buy 4 books in my first year of membership. I do not need to take a book each month. If I want an alternative to the main selection, or no book at all I will tell you so on the form provided. I am over 18 years of age.

Write the codes for your choices here:

Mr/Mrs/Miss _____

(please print)

Address _____

Postcode _____

Signature _____ X1

SEND NO MONEY NOW/Post to The Computer Book Club, Wiley Dist. Centre, Oldlands Way, Bognor Regis, W. Sussex PO22 9SA
 Offer limited to one per household. Allow up to 6 weeks for delivery. The Computer Book Club is a division of John Wiley & Sons Ltd Reg. no. 641132 England

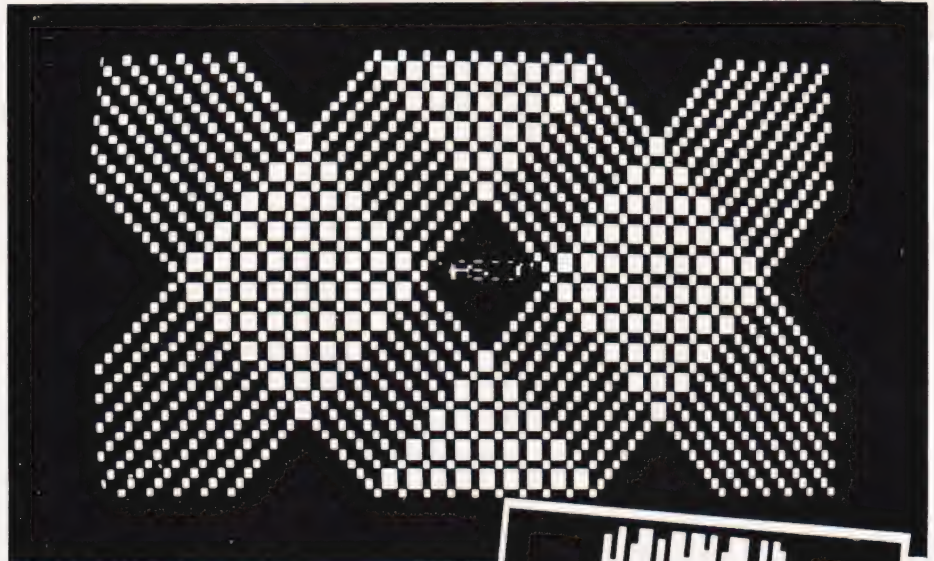
NAS DRAW

Pete Dann

You can certainly produce pictures on a screen, you may even be able to print them out but can you save them on tape? With this clever little utility you can!

This sketching program for the NASCOM allows easy composition of pictures from the pixels of the NAS-GRA graphics ROM and all available alphanumeric characters. It was written on a NASCOM 2 with the NAS-SYS 1 monitor and contains machine code subroutines (Listing 1); modifications to these subroutines will be required for other monitors.

The pictures are produced by using the 18 commands listed in Table 1 and can be stored on tape and recalled easily by any BASIC program. The examples shown here, some from an adventure program, were all drawn using this program.



Some examples of block graphics created using the NAS-GRA ROM. These designs can be stored on tape using the disc utility program.



Subroutine A (at 0D00 Hex)

```

0D00 21 01 0C      LD HL,0C01
0D03 06 09      LD B,9
0D05 36 00      LD (HL),0
0D07 23      INC HL
0D08 10 FB      DJNZ,0D05
0D0A DF 62      SCAL IN
0D0C 38 01      JR C,0D0F
0D0E AF      XOR A
0D0F 47      LD B,A
0D10 AF      XOR A
0D11 2A 0D E0   LD HL,(E00D)
0D14 E9      JP (HL)
0D15 00      NOP
    
```

Subroutine B (at 0D16 Hex)

```

0D16 DF 7B      SCAL BLINK
0D18 FE 2F      CP '/'
0D1A 20 01      JR NZ,0D1D
0D1C C9      RET
0D1D F7      RST ROUT
0D1E C3 16 0D   JP 0D16
    
```

Listing 1. The two machine code routines.

On **LOADING** and **RUNNING** the program, the user is presented with a blinking pixel cursor in the centre of the screen; this blinks continuously as a reminder of the current drawing position (CDP). The cursor can be moved horizontally or vertically by pressing the appropriate cursor control key and will continue to move as long as the key is held down. It can also be moved diagonally up or down by using the same keys whilst holding the 'CTRL' key down; the keys on the left move it up and left and down and left and those on the right move it up and right and down and right (see Table 1). Movement of the cursor is confined to the screen area by the program so there is no danger of 'going off the edges'!

| COMMAND | ASCII CODE | ACTION |
|------------------------------------|------------|---|
| Moves: | | |
| ← | 17 | Move cursor left. |
| → | 18 | Move cursor right. |
| ↑ | 19 | Move cursor up. |
| ↓ | 20 | Move cursor down. |
| CTRL + ← | 81 | Move cursor down and left. |
| CTRL + → | 82 | Move cursor up and right. |
| CTRL + ↑ | 83 | Move cursor up and left. |
| CTRL + ↓ | 84 | Move cursor down and right. |
| Modes: | | |
| D | 68 | Set DRAW mode. |
| M | 77 | Set MOVE mode. |
| E | 69 | Set ERASE mode. |
| C | 67 | Set CHARACTER mode. |
| Misc: | | |
| 'carriage-return' or 'cursor-home' | 23 | Position cursor at beginning of current line. |
| H (HOME) | 72 | Position cursor at top left of screen. |
| B (BLANK) | 66 | Clear screen and centre cursor. |
| L (LINE) | 76 | Clear current line. |
| P (PICTURE) | 80 | Save picture on tape. |
| / | 47 | End character mode or end program. |

Table 1. The command table; the functions and their corresponding codes.

Program Listing

```

10 DIM PIC(720),AS(18)
19 REM ** LOAD MACHINE CODE SUBROUTINES
20 FOR L=3328 TO 3360 STEP 2
30 READ J:DOKE L,J:NEXT L
40 DOKE 4100,3328
50 FOR L=1 TO 18:READ AS(L):NEXT L
60 CLS:X=45:Y=18
69 REM ** SCAN KEYBOARD FOR INPUT
70 U=USR(0):IF U<>0 THEN GOSUB 110
79 REM ** BLINK IF NO INPUT FOUND
80 FOR L=1 TO 20:NEXT L:SET(X,Y)
90 FOR L=1 TO 20:NEXT L:RESET(X,Y)
100 GOTO 70
109 REM ** FIND INPUT IN AS()
110 FOR L=1 TO 18
120 IF U=AS(L) THEN U=L:GOTO 140
130 NEXT L
140 ON U GOTO 320,350,330,360,310,300
150 ON U-6 GOTO 290,340,180,200,190,240
160 ON U-12 GOTO 210,220,60,230,490,590
170 RETURN
179 REM ** SET DRAW, MOVE OR ERASE MODE
180 D=1:RETURN
190 D=-1:RETURN
200 D=0:RETURN
209 REM ** CARRIAGE RETURN, HOME & BLANK LINE
210 X=0:RETURN
220 X=0:Y=0:RETURN
230 SCREEN X/2+1,Y/3+1:PRINT CHR$(27):RETURN
239 REM ** SET CHARACTER MODE
240 DOKE 4100,3350:SCREEN X/2+1,Y/3+1
250 U=USR(0):FOR L=1 TO 2500:NEXT L
260 D0=0:D=0:DK=DEEK(3113)-1993
270 Y=INT(DK/64):X=(DK-64*Y)*2:Y=Y*3-2
280 DOKE 4100,3328:GOTO 440
289 REM ** SET CO-ORDINATES FOR NEW POSITION
290 X1=-1:Y1=-1:GOTO 370
300 X1=1:Y1=-1:GOTO 370
310 X1=-1:Y1=1:GOTO 370
320 X1=-1:Y1=0:GOTO 370
330 X1=0:Y1=-1:GOTO 370
340 X1=1:Y1=1:GOTO 370
350 X1=1:Y1=0:GOTO 370
360 X1=0:Y1=1
369 REM ** MOVE (OPTIONALLY WITH DRAW/ERASE)
370 IF D0=1 THEN D0=0:POKE P1,C1
380 IF D=1 THEN SET(X,Y):GOTO 430
390 IF D=-1 THEN RESET(X,Y):GOTO 430
399 REM ** STORE CHARACTER AT PRESENT POSITION
400 D0=1
410 P1=1993+INT((X+X1)/2+1)+64*INT((Y+Y1)/3+1)
420 C1=PEEK(P1)
430 X=X+X1:Y=Y+Y1
439 REM ** CHECK FOR OFF SCREEN
440 IF X>95 THEN X=95
450 IF Y>44 THEN Y=44
460 IF X<0 THEN X=0
470 IF Y<0 THEN Y=0
480 RETURN
489 REM ** STORE PICTURE
490 F=0
500 FOR F1=2058 TO 2954 STEP 64
510 FOR F2=0 TO 47:PIC(F)=PEEK(F1+F2)
520 F=F+1:NEXT F2:NEXT F1
530 CLS:PRINT "START CASSETTE IN RECORD MODE"
540 PRINT "PRESS <ENTER> WHEN READY";
550 INPUT AS:CSAVE* PIC
560 PRINT:PRINT "OK PICTURE HAS BEEN SAVED"
570 FOR F1=1 TO 5000:NEXT F1
580 CLS:N=0:FOR X=2058 TO 2954 STEP 64
590 FOR Y=0 TO 47:POKE X+Y,PIC(N):N=N+1
600 NEXT X,Y:X=45:Y=18:D=0:RETURN
610 END
619 REM ** MACHINE CODE DATA
620 DATA 289,1548,13833,8960,-1264,25311,312
630 DATA 18351,10927,-8179,233
640 DATA 31711,12286,288,-2103,5827,13
649 REM ** ASCII CODES FOR COMMAND LETTERS
650 DATA 17,18,19,20,81,82,83,84
660 DATA 68,77,69,67,23,72,66,76,80,47

```

Listing 2. The picture draw and save routine.

In The Mode

What happens on the screen when the cursor is moved depends upon the mode of operation selected. There are three 'line' modes and one 'character' mode. The three 'line' modes are DRAW, MOVE and ERASE; these can be set at any time by entering the D, M and E commands. DRAW will cause a line to be drawn as the cursor is moved about the screen, ERASE will cause any lines or characters the cursor passes through to be rubbed out and MOVE will allow the cursor to be moved without drawing or erasing. The program is initialised in the MOVE mode.

The 'character' mode is set by entering the C command. This causes a departure from the normal drawing operation of the program to a machine code subroutine allowing the user to enter any alphanumeric or graphic character from the keyboard, including the NAS-SYS editing features. Operation will continue in this mode until a slash, / (ASCII code 47), is entered returning it to the MOVE mode. (NB this character can be obtained for use in

a picture by using ASCII code 88 Hex / 136 decimal which is GRAPH/CTRL/H).

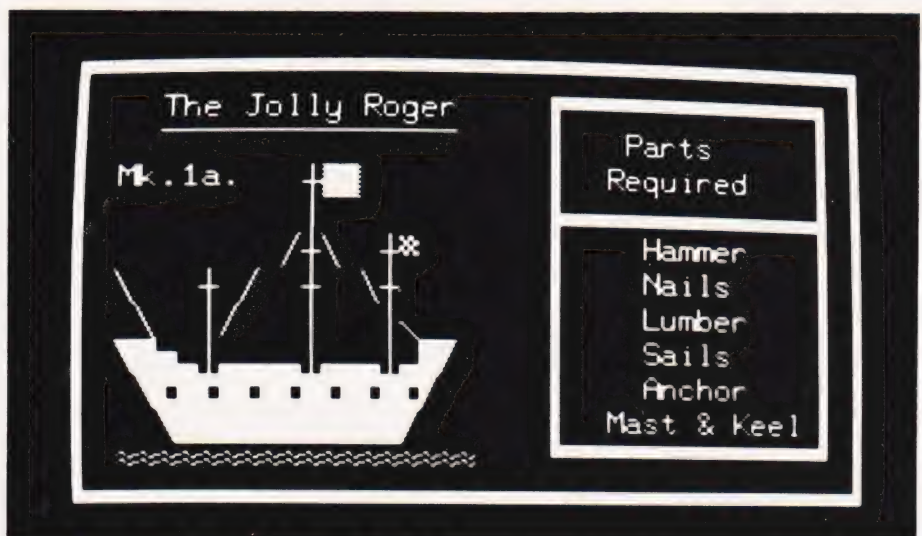
Pressing the carriage return key (or 'cursor home') will move the cursor to the beginning of the current drawing line and the H command will move it to the top left corner of the screen. The B command will

```

999 REM ** LOAD AND DISPLAY
    SAVED PICTURE
1000 DIM PIC(720):CLOAD* PIC
1010 FOR X=2058 TO 2954 STEP 64
1020 FOR Y=0 TO 47
1030 POKE X+Y,PIC(N)
1040 N=N+1:NEXT Y:NEXT X

```

Listing 3. The picture recall routine.



Mixing text and graphics.

NAS DRAW

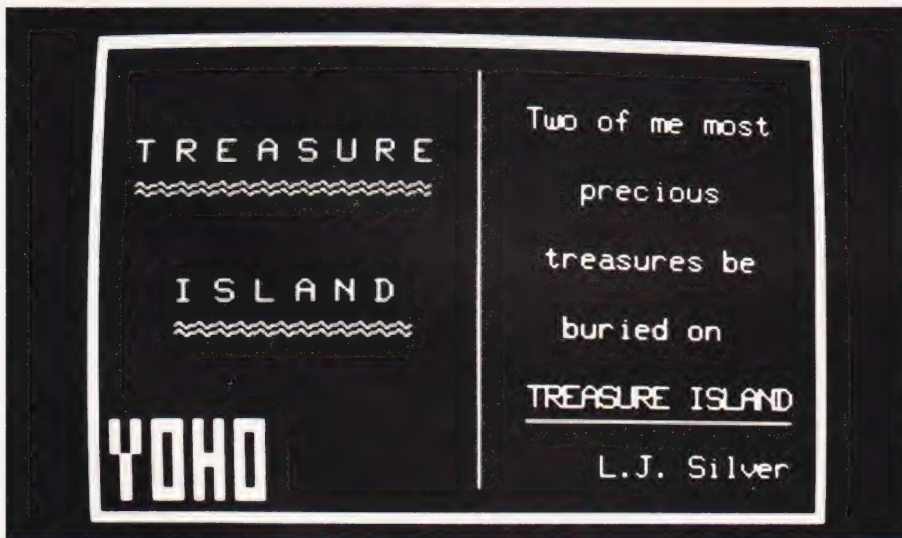
blank the screen and reposition the cursor at the centre, the L command then blanking the line (to the height of one character) on which the cursor is currently situated. By moving the cursor to the bottom of the screen and typing L it is possible to scroll the whole picture upwards. When not in the character mode, typing a slash will terminate execution of the program.

The P command is included to facilitate the storing of pictures on tape. This is achieved by storing each byte of the screen memory as an element of the PIC array and using the BASIC CSAVE* command to save the whole array on tape.

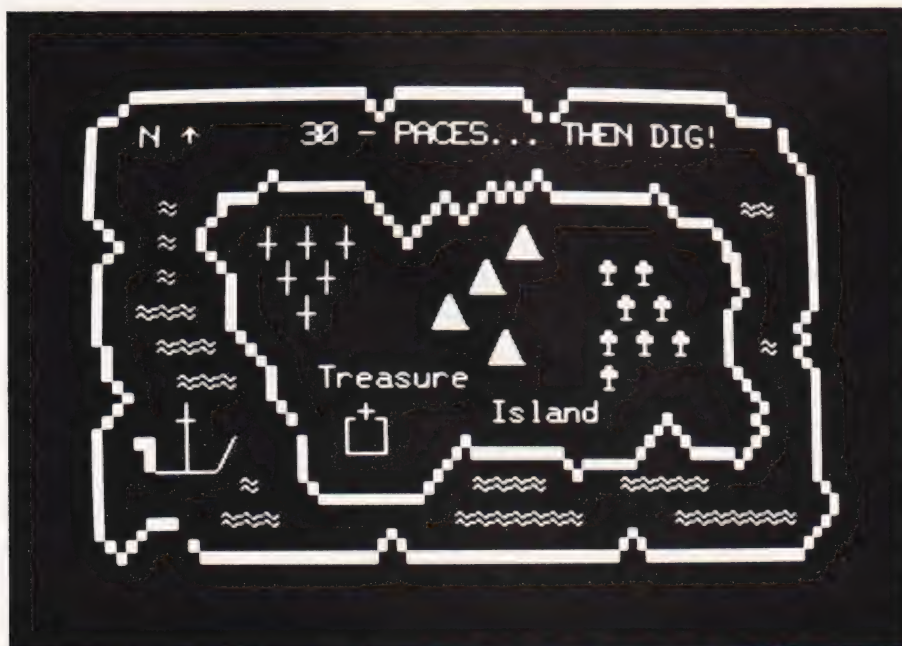
Messages appear on the screen to show the start and finish of this operation and on completion, the picture is displayed again and the program returns to the MOVE mode.

To READ in a picture from tape the BASIC CLOAD* command must be used in a routine such as that in Listing 3.

The program contains two machine code subroutines A and B (Listing 1). Subroutine A is called at line 70 and scans the keyboard to see if any key has been pressed (ie any command entered); subroutine B is called at line 250 and controls the operation of the character mode.



A couple of pictures from an adventure game; illustrations for each section of the game can be stored on tape.



How It Works

The following breakdown provides a guide to understanding how the program works and will be useful if you are trying to adapt it for use with other monitors or micros. The REM statements show the various sections quite clearly but may be omitted without any dire consequences.

Line 10: The PIC array will contain all the individual parts of a picture when saved on tape. The AS array contains the ASCII codes of all the legal commands (obtained from the DATA statements in lines 630-640).

Line 20: The data for the machine code subroutines are read and DOKEd into memory from 0D00 Hex onwards.

Line 60: The CDP is set to the centre of the screen and blinked there until a command is entered.

Line 110: The AS array is searched to try to find a match for the ASCII code of the command that has just been entered. If no match is found the command must have been 'illegal' and another one is awaited.

Line 180: If the command was D, E or M then the variable D is set to 1, -1 or 0 respectively.

Line 210: If the command is 'carriage return', H or L then the CDP is modified accordingly. For L, an ESCAPE character is also printed.

Line 240: If the command was C then CHARACTER mode is set by calling the machine code subroutine at 0D16 Hex. Control stays within this subroutine until a slash is entered.

Line 290: If the command was a cursor movement command the CDP is modified accordingly.

Line 370: The CDP is either SET, RESET or stored for later recall depending on whether the DRAW, ERASE or MOVE mode was in operation.

Line 440: The CDP is maintained if a cursor movement is entered attempting to place the cursor outside the screen limits.

Line 490: If the command was P then each byte of the screen memory is stored as an element of the PIC array. Instructions are then given to switch on the tape recorder and when the array has been saved, a message to this effect is printed. Finally the picture is returned to the screen, the CDP is centralised and the program continues in MOVE mode.

Line 590: If the command was a slash and the CHARACTER mode is not in operation, then execution of the program is terminated.

Memotech's New Memory System for the ZX81

It grows as you progress



Memopak 16K Memory Extension

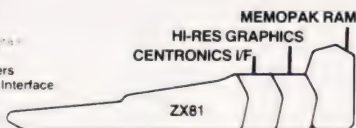
- £39.95 incl.VAT

It is a fact that the ZX81 has revolutionised home computing, and coupled with the new Memopak 16K it gives you a massive 16K of Directly Addressable RAM, which is neither switched nor paged. With the addition of the Memopak 16K your ZX81's enlarged memory capacity will enable it to execute longer and more sophisticated programs, and to hold an extended database.

The 16K and 64K Memopaks come in attractive, custom-designed and engineered cases which fit snugly on to the back of the ZX81, giving firm, wobble-free connections. See below for ordering information.

Coming Soon...

A complete range of ZX81 add-on peripherals:
 Memotech Hi-Res Graphics
 Centronics Interface and Software Drivers
 Memotech Digitising Tablet RS232 Interface



All these products are designed to fit 'piggy-back' fashion on to each other, and use the Sinclair power supply. WATCH THIS SPACE for further details. We regret we are as yet unable to accept orders or enquiries concerning these products - but we'll let you know as soon as they become available.

How to order your Memopak.

By Post: Fill in the coupon below and enclose your cheque/P.O./Access or Barclaycard number.

By Phone: Access/Barclaycard holders please ring Oxford (0865) 722102 (24-hour answering service).

Please make cheques payable to Memotech Limited
 Please debit my Access/Barclaycard* account number

*Please delete whichever does not apply

SIGNATURE _____ DATE _____

NAME _____ ADDRESS _____

Please send me:

| | Quantity | Price | Total |
|-----------------------|----------|---------|-------|
| 16K RAM, Assembled | | £39.95 | |
| 64K RAM, Assembled | | £79.00 | |
| | | Postage | £2.00 |
| Total Enclosed | | | |



Memopak 64K Memory Extension

-£79.00 incl.VAT

The 64K Memopak is a pack which extends the memory of the ZX81 by a further 56K, and together with the ZX81 gives a full 64K, which is neither switched nor paged, and is directly addressable. The unit is user transparent and accepts basic commands such as 10 DIM A(9000).

BREAKDOWN OF MEMORY AREAS

- 0-8K ... Sinclair ROM
- 8-16K ... This section of memory switches in or out in 4K blocks to leave space for memory mapping, holds its contents during cassette loads, allows communication between programmes, and can be used to run assembly language routines.
- 16-32K ... This area can be used for basic programmes and assembly language routines.
- 32-64K ... 32K of RAM memory for basic variables and large arrays.

With the Memopak 64K extension the ZX81 is transformed into a powerful computer, suitable for business, leisure and educational use, at a fraction of the cost of comparable systems.

Unique 3 month trade-in offer!

When your programming needs have outgrown the capacity provided by 16K RAM, and you find it necessary to further extend your ZX81's capacity, we will take back your 16K Memopak and allow a discount of £15.00 against your purchase of our 64K model.*

**We reserve the right to reject, for discounting purposes, units which have been either opened or damaged in any way.*

© R. Branton & G. A. C. Boyd 1982

CT/6/82

We want to be sure you are satisfied with your Memopak - so we offer a 14-day money back Guarantee on all our products.
Memotech Limited, 3 Collins Street, Oxford OX4 1XL, England Telephone: Oxford (0865) 722102/3/4/5

Make the most of your Sinclair ZX Computer...

Sinclair ZX software on cassette.

£3.⁹⁵ per cassette.



The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 – if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack is described below. And the description of each cassette makes it clear what hardware is required.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 and the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.

Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 – Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status – digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12

missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes **MEAN** from **MEDIAN**.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

Cassette 6 – Family Quiz

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack.

Four different quizzes, each consisting of 10 questions suitable for the whole family. There's a target time for each quiz, and at the end you're told how long you took to answer the questions – and how many you got right. The quizzes cover a range of topics – including maths, English grammar, and general knowledge.

How to order

Simply use the order form below, and either enclose a cheque or give us the number of your Access, Barclaycard or Trustcard account. Please allow 28 days for delivery. 14-day money-back option.

sinclair ZX SOFTWARE

Sinclair Research Ltd,
6 Kings Parade, Cambridge,
Cams., CB21SN. Tel: 0276 66104.

To: Sinclair Research FREEPOST, Camberley, Surrey. GU15 3BR.

Please send me the items I have indicated below.

Please print

| Qty | Code | Item | Item price | Total |
|-----|------|-------------------------------------|------------|-------|
| | 21 | Cassette 1 – Games | £3.95 | |
| | 22 | Cassette 2 – Junior Education | £3.95 | |
| | 23 | Cassette 3 – Business and Household | £3.95 | |
| | 24 | Cassette 4 – Games | £3.95 | |
| | 25 | Cassette 5 – Junior Education | £3.95 | |
| | 26 | Cassette 6 – Family Quiz | £3.95 | |
| | 17 | *8K BASIC ROM for ZX80 | £19.95 | |
| | 18 | *16K RAM pack for ZX81 and ZX80 | £29.95 | |
| | | *Post and packing (if applicable) | £2.95 | |
| | | | Total £ | |

*Please add £2.95 to total order value only if ordering ROM and/or RAM.

I enclose a cheque/PO to Sinclair Research Ltd for £ _____

Please charge by Access*/Barclaycard/Trustcard no. _____

*Please delete as applicable.

Name: Mr/Mrs/Miss _____

Address: _____

SOF06

CONNECT PANEL METERS TO YOUR APPLE EASILY



for only **£95.00**

The U-BCD is an easy to install & program panel meter interface that accepts up to 8 decimal digits in BCD (Binary Coded Decimal) format. And look how many types of equipment incorporate panel meters!

Available from Apple Dealers worldwide or direct from U-Microcomputers.

Prices do not include VAT or p. & p. (£1.00 per board)
 U-Microcomputers Limited,
 Winstanley Industrial Estate,
 Long Lane, Warrington,
 Cheshire, WA2 8PR, England.
 Telephone: 0925 54117/8
 Telex: 668920 U-ONE



U-MICROCOMPUTERS

a range of quality peripheral cards to enhance your Apple

We now make more Apple cards than Apple!

ZX81 HARDWARE

40 KEY KEYBOARD. Kit £20.95 Built £25.75 (RE77)

- * Proper typewriter style keys.
- * All legends and graphics in two colours.
- * No soldering required to ZX81. Plugs in. (RAM/Printer not affected)
- * Complete with all parts, connectors, feet and comprehensive instructions.

24 LINE IN/OUT PORT. Kit £16.95 Built £18.95 (RE98)

- * Each line either in or out.
- * Controlled by BASIC.
- * Allows printer/RAM to be used without a motherboard) (Motherboard version kit £13.50 built £14.50)

3 CHANNEL SOUND/TIMER BOARD. Kit £16.95 Built £18.95 (RE161)

- * 3 independent channels.
- * Controlled by BASIC.
- * Full range of notes.
- * Complete instructions with examples provided.
- * Can be used as a sophisticated timer/counter.

MOTHERBOARD. Kit £15.75 Built £18.50 (RE82)

- * Two connectors on board.

CONNECTORS & PLUGS

- * 23 Way female connector for ZX80/1. (RE80) **£2.95**
- * 23 Way male connector. (RE87) **£1.30**
- * 23 Way male connector to fit two female connectors together. (RE90) **£1.60**
- * 30 Way ribbon cable. **£1.40** metre.
- * RAM pack connector. Allows RAM pack to be remote from ZX80/1. RE170. **£6.95** built.
- * In/out connector & sound board connector (RE78B) **£2.95.**

BOOKS & TAPES

- Getting acquainted with ZX81. **£4.95**
- Mastering machine code. **£5.95**
- Programming for real applications. **£6.95**
- Tape for real applications book. **£11.44**

Send SAE 5" x 7" for free illustrated catalogue.

Payment: Cash with order. Or ACCESS/
 Official orders welcome. Dealers write for rates.

All prices include P + P and VAT. Overseas add £1.80

REDDITCH ELECTRONICS. DEPT CT.
21 FERNEY HILL AVE, REDDITCH, WORCS
B97 4RU. Tel:(0527) 61240.

Once more in to the troubled waters of program conversion, the book question and, the BBC Micro.

Welcome, once again, to the warm and friendly atmosphere of the 'micro clinic' — this magazine's answer to All Creatures...! My apologies for its absence in the last issue, I trust no-one pined away as a result but The Valley absorbed almost all our efforts. Well, that's my excuse and I'm sticking to it!

The varied mail bag has once again produced a crop of enquiries on topics ranging from the BBC Computer to the apparent inability of certain people to actually read the words we so carefully write on the page.

The Book Question

Ever since we started reviewing books on a regular basis we have been inundated with readers asking about other sources of reference. Among those landing on the office mat in the last few weeks was one from Mr Frater of the North East Wales Institute of Higher Education.

I am currently investigating connecting our SWTP 6800 and PET 8032 computers to control external devices. As my knowledge in this field of computing is limited I wondered if there were any good books in this area.

The answer is a simple 'Yes'. The problem is that there are so many good books to choose from! However, I'd pick the following three, not because they specifically relate to the computers you mention but because they are excellent textbooks on the subject from which you should be able to glean all the information you need. They are in no particular order of preference:

Practical Hardware Details for 8080, 8085, Z80 and 6800 Microprocessor Systems by James W Coffron and published by Prentice Hall. The ISBN is 0-13-691089-0 and I'm afraid I've lost the price.

Microcomputer Interfacing by G Jack Lipovski and published by Lexington Books. The ISBN is 0-669-03619-6 and, once again, the price is missing.

Computers and Instrumentation by A Carrick and published by Heyden. The ISBN is 0-85501-452-0 and yes, you've guessed it, the price has fallen out!

On reflection I seem to remember that all were around the

£15 mark in hardback but it would be wise to check first.

Still on the subject of books, Mr Law from somewhere unspecified (resisting all those possible puns about addresses was a severe effort) asks:

I hope you can introduce me to a book about programming the 6502.

Here opinions differ. I would personally recommend Leventhal's book, **6502 Assembly Language Programming** which is published by Osborne (McGraw Hill in the UK). However, my colleagues who do the book reviews each month would recommend **Programming the 6502** by Rodney Zaks. This is published by Sybex and is available in the UK from The Computer Bookshop in Birmingham. The prices were £12.10 and £10.25 respectively at the last check.

Let There Be Light

The subject of light pens for use with personal computers is one that rears its head from time to time and the following inquiry from Mr J R Davies of Lancaster is a typical example.

I want to use my BBC Microcomputer in an application where a light pen may be the most appropriate input device. Can you tell me the names and addresses of any suppliers and whether any special programming is needed.

Apart from the simple light pen design that we published some months ago (you'll have to write your own programs for it) and the one that the BBC should be introducing for the computer, the only one I am aware of comes from Arfon Microelectronics of Cibyn Industrial Estate, Caernarfon, Gwynedd. Now, whether they have yet made a BBC compatible version I'm not sure, but the original version was fairly general purpose and costs around £80 plus the ever present VAT.

As for programming the device, it is impossible to say exactly what will be needed without knowing a great deal more about the actual application. In general I would expect the light pen to come with a control program which could be incorporated into your own software as a special subroutine.

Barrowing Away

Back in our January issue we published a logical adventure game called The White Barrows. Because it was written for the Acorn ATOM which uses a somewhat odd version of BASIC we were fairly careful to point out all the possible points that might need conversion for other types of computer. Now, we know that the game works and that people have managed to convert it — one dedicated individual even has a version running on the Casio FX702 Pocket Computer!

There was, however, one special symbol which we missed, and this occurs at the very beginning of the program. The symbol is @ and can be totally ignored for all other versions of BASIC as its sole purpose in life is to determine the number of spaces available for each number to be displayed in. I trust that answers Mr Foster's enquiry.

The point of this little piece is that two other readers have written in with virtually identical inquiries on the program. Apart from the single point about the @ symbol they go on at extreme length about various other symbols used which they don't appear to understand. The trouble is that they are, without exception, listed and detailed in the text! In fact, we were so worried about the problems this program might cause that we even put a REM in the first line which says PLEASE READ THE TEXT FIRST !!!!!

The moral is, I hope, clear. Before you put pen to paper to write in and enquire about a particular aspect of a program we publish — bugs excepted of course — please read the text and see if it holds the answer. If nothing else it'll save you a stamp!

Given that you can't solve the problem, write to use, **don't phone**, and enclose an SAE at least 9½" by 6½" (A5) and we'll do our best to solve your troubles. The more information you give about the problem the more likely it is that we'll have an answer; statements such as 'It just stopped at line 50' are not much help. A more accurate description of the problem might be 'The screen cleared, there was a pause and then the program stopped with the error message DIV'N BY ZERO IN LINE 50'. Given that sort of detail we can (hopefully) solve the bug.

INNOVATIVE TRS 80-GENIE SOFTWARE

from the professionals

SNAPP-WARE

NOW - SAME PRICE IN U.K. AS IN U.S.!

When Robert Snapp of Snapp-Ware sat down to start to write his line of utilities for the Model II and Model III Tandy machines, he made one very important decision. Wherever possible the utility was to be embedded in the Basic interpreter so that the user would have maximum ease of use. This has been so successful that unless an appropriate notice were displayed on entering Basic, the operator would literally never know that the enhancements were present.

Snapp-Ware has achieved fantastic success in the United States, but has not really been promoted to any extent in this country. We have now been using Mr. Snapp's utilities for some time and we intend to try our best to change this state of affairs, not only because we want Snapp software to sell, but also we sincerely feel that the Tandy user should have the benefit of these utilities, some of which are capable of cutting the Basic programmer's time down by an astounding amount.

In order to achieve this promotion, we have decided to market Snapp-Ware at the **same price** in the United Kingdom as it is sold for in the United States (the calculations being on prices existing in March 1982 and using \$2 to the pound conversion rate).

The three most important utilities are Extended Basic, Extended Built-in Functions and Garbage Collector. These, and the others, are so comprehensive that it is not possible to describe them in full in this advertisement so a pamphlet has been prepared describing the whole line and is available on request. A short description of the three mentioned follows, but it must not be forgotten that these are all built-in utilities — they are essentially a part of the interpreter and therefore transparent to the user.

EXTENDED BASIC

Single Keystroke Commands There are six, essentially duplicating those in NEWDOS+ for displaying first and last lines etc.

Single Letter Abbreviations There are ten of these covering such commands as EDIT, KILL, CLS and DELETE.

Cross Reference Extensive cross reference for variables and integers.

Dump Dumps all variables to the screen or to the printer with the current values.

Renumber Deluxe renumbering utility, including moving.

Find Locates all strings and basic keywords in a program.

Compress Reduces a program to its minimum configuration.

EXTENDED BUILT-IN FUNCTIONS

The most important function in this suite is a super fast in-memory sort routine capable of sorting (for instance) 2,000 strings in 10 seconds, or 10,000 integers in 39 seconds. These figures are for random items.

In addition, there are about 30 (depends in part on whether it is a Model II or Model III machine) extra commands such as — for the Model II, PEEK and POKE; the ability to read a string straight from the video display on the Model II; returning row numbers on the Model III; packing and unpacking strings on both machines.

GARBAGE COLLECTOR

This utility essentially gets rid of the annoying apparent hang up which is inherent in Microsoft Basic when it is sorting out its string space. The use of this utility means that this problem is really no longer existent. Two versions are supplied, one which uses a working file in memory and the other on disk. The following is a table of comparisons carried out by Snapp. It will be seen that the time saving is dramatic even if a disk work file is used.

| No. of Strings | Normal Time [secs.] | In Memory [secs.] | Disk [secs.] |
|----------------|------------------------|----------------------|-----------------|
| 250 | 5.1 | .42 | 2.36 |
| 500 | 20 | .98 | 3.87 |
| 1000 | 75 | 2.34 | 7.40 |
| 2000 | 294 | 5.40 | 14.30 |
| 4000 | 1168 | 12.40 | 29.10 |

Extended Basic

U.S. price \$200 (Mod. II) \$125 (Mod. III) Our price £100 (Mod. II) £62.50 (Mod. III)

Extended Built-in Functions

U.S. price \$100 (Mod. II) \$ 75 (Mod. III) Our price £ 50 (Mod. II) £37.50 (Mod. III)

Garbage Collector

U.S. price \$100 (Mod. II) \$ 75 (Mod. III) Our price £ 50 (Mod. II) £37.50 (Mod. III)

All prices are exclusive of V.A.T. First class registered shipping £1.50.



MOLIMERX LTD

A J HARDING (MOLIMERX)

1 BUCKHURST ROAD, TOWN HALL SQUARE, BEXHILL-ON-SEA, EAST SUSSEX.

TEL: [0424] 220391/223636

TELEX 86736 SOTEX G

TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [refundable] plus £1 postage.



INNOVATIVE TRS 80-GENIE SOFTWARE

from the professionals

LDOS

VERSION 5.1 THE TRS-80™ OPERATING SYSTEM MODEL I AND III

- * **DOUBLE** Sided & **DOUBLE** Density support.
 - * **AUTOMATIC** Density recognition.
 - * 35, 40, 77, 80 and any other track counts are supported.
 - * All available drive stepping rates are supported.
 - * Hard Drive support, can be **HANDLED AS A SINGLE DRIVE**.
 - * Hard drive partitioning, one drive can act as up to six.
 - * Intermix 5", 8" and Hard drives, up to a total of 8 drives.
 - Compatible with the Model I Radio Shack Expansion Interface.
 - Upward compatible with **TRSDOS** (2.3 & 1.2 as documented)
 - Fully supports Microsoft language products for the **TRS-80**.
 - Complete media compatibility Model I to Model III and back
 - Full support for **LOBO's LX-80** interface.
 - Full support for **AEROCOMP LC** double density controller (DDC).
 - Full support for **PERCOM's DOUBLER II**.
 - Complete documentation (well over 250 pages).
 - Complete technical information.
 - A Quarterly **LDOS** users magazine (The **LDOS QUARTERLY**).
 - A liberal update policy.
 - An enhanced **BASIC (LBASIC)** including:
 - > Upward compatible with Microsoft Basic.
 - > High speed **LOAD** and **SAVE**.
 - > Run multiple programs with common variables.
 - > **BLOCKED** (variable length) files are supported.
 - > **DOS** commands may be executed from **LBASIC**.
 - > Built in string array. **SORT**.
 - > Single stepper for debugging.
 - > Several new statements and file modes.
 - A compiled **JOB CONTROL LANGUAGE (JCL)**.
 - **CONVERT** utility to move files from Model III **TRSDOS**.
 - An Extended Debugging and Monitor program (with disk access).
 - **CMDFILE** for movement of disk and/or tape system (**/CMD**) files.
 - Device independent operation
 - Full **LINKing**, **ROUTEing**, **FILTERing** and **SETting** are supported.
 - **MiniDOS** feature for constant access to certain **DOS** commands.
 - **RS-232 DRIVER** for serial support
 - Sophisticated communications software included.
 - Wildcard characters and partial Filespecs are supported.
 - **DATED FILES**, show when a file was last written to.
 - Backup: Mirror, by Class, if Modified, by Date, by Extension, etc.
 - Selectable **PURGE** for fast disk "cleanup" of unwanted files.
 - Print formatter, for control of printer output.
 - Built in printer **SPOOLER**, to both disk and ram.
 - Joblog to record all system operations with time stamps.
 - **UPPER** and **lower** case support, throughout the system.
 - Blinking cursor with selectable cursor character.
 - 128 character **TYPE AHEAD** buffering for keyboard input.
 - Assign strings to individual keys with Key Stroke Multiply (**KSM**).
 - **SUPER FAST** operation with the **SYSRES** feature.
 - Extensive user control and system feedback.
 - Advanced **PATCH** utility for easy maintenance.
 - Complete transportability of software among all **Z-80 LDOS** systems through the use of the **LDOS** high ram supervisory call system (**SVC**).
- * Specific hardware is required to use these features

LDOS for TRS-80 I/III and all current Genie machines
£85.00 + V.A.T. and P & P £3 Received Parcel Post



MOLIMERX LTD

A J HARDING (MOLIMERX)

1 BUCKHURST ROAD, TOWN HALL SQUARE, BEXHILL-ON-SEA, EAST SUSSEX.

TEL: [0424] 220391/223636

TELEX 86736 SOTEX G

TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [refundable] plus £1 postage.



Support for ATOM and ZX

The Atom Magic Book

A wealth of games and other programs: storing speech in your ATOM, converting programs written in other BASICS, tape recording hints, and many more useful software and hardware tips. £5.50

Getting Acquainted with your Acorn Atom

By Tim Hartnell and Trevor Sharples. 80 programs including Draughts! £7.95

The Memory for your ATOM

16 or 32K¹ BYTE VERSIONS Expand your ATOM to 28 or 38K RAM
Ideal for Word Processing, Chess programs and Business Software.
Fully Compatible with other Acorn ATOM software and hardware
Versions available to fit inside the ATOM while still leaving room for other extensions such as the Acorn ATOM colour encoder board.
Eurocard rack mounting types also available

PRICES: INCLUDING U.K. P&P & 15% VAT

| | |
|---|--------|
| MZ163A 16K Built & tested to fit inside ATOM'S case | £59.50 |
| MZ163B 32K " " " " | £74.00 |
| MZ163C 16K Built & tested, Eurocard rack mounting | £62.00 |
| MZ163D 32K " " " " | £76.50 |
| MZ163E Bare PCB to build any of above with data | £23.00 |
| MP100 DC/DC converter; powers any MZ163 board from unregulated 8V supply such as the ATOM mains adaptor | £8.50 |

S.A.E. for further details.



ALL PRICES INCLUDE U.K. P&P + 15% VAT WHERE APPLICABLE. OVERSEAS CUSTOMERS ADD £1.50 CARRIAGE PER ORDER PAYMENT WITH ORDER PLEASE.

TIMEDATA LTD Dept B 57 Swallowdale, Basildon.
Essex. SS16 5JG Tel: (0268) 411125 (MON-FRI)

The Explorer's Guide to the ZX81

IF YOU'VE GOT A ZX81 THEN YOU NEED THIS BOOK!

Programs for 1K RAM, and programs for 16K RAM. Games, Business and Engineering Applications. RAM & I/O Circuits. Useful ROM Routines. Hints and Tips. 120 pages £4.95

What Can I Do with 1K?

By Roger Valentine. A fresh and original book containing 40 programs and routines for the unexpanded ZX81. £4.95



34 Amazing Games for the 1K ZX81

by Alastair Gourlay. £3.95

The ZX80 Magic Book

With 8K ROM/ZX81 Supplement

Games programs, computer music, converting programs written in other BASICS, improving the picture RAM & I/O circuits, and much more. £4.75

Getting Acquainted with your ZX81

75+ programs including Draughts; by Tim Hartnell £4.95

Mastering Machine Code on your ZX81

by Toni Baker. 180 pages of immense value to beginner and expert alike. £5.95

TIMEDATA

NASCOM

FULLY BUILT AND TESTED SYSTEMS

CARRY ONE YEAR GUARANTEE

NASCOM 2

16K in Microtype Case, Graphics and Sound

£395.00

48K in Kenilworth Case, Nas-Sys 3 and Graphics Sound

£499.00

NASCOM 3

8K in Nascom Case, Graphics, Nas-Sys 3

£416.00

16K in Nascom Case, Graphics, Nas-Sys 3

£476.00

NASCOM

Single Disc Drive

£470.00

Dual Disc Drive

£685.00

NASDOS

Disc Operating System

£45.00

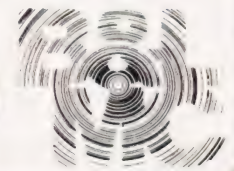
CP/M 2.2

Disc Operating System

£100.00

PRINTERS Epson MX80 F/T dot matrix printer. Olympia daisy wheel printers - RO or KSR. Telephone for further information and prices.

SHARP MZ80B Now on demonstration with WORDSTAR and CALCSTAR. All the above prices exclude VAT



Business & Leisure Micro Computers

16, The Square, Kenilworth Tel: (0926) 512127

SIMULATING FORTH

Owen Bishop

If you like the look of FORTH as a programming language but are not yet convinced it is the right one for you, why not try out our simulator? Written in BASIC, it will allow you to produce simple programs with ease.

Having been impressed by D S Peckett's series on GOING FORTH in recent issues of Computing Today, I felt that this language had a lot to offer; indeed I wondered if it might be more suitable than BASIC for many of my current projects. I resolved to investigate the language further.

However, the prices of even the simplest versions available in the UK or from the USA are not cheap. Undoubtedly the prices are fair and reasonable but, before spending such an amount, I wanted to be certain that FORTH would suit my requirement fully. More significantly, I wondered if *I* would suit FORTH's requirements. Two points left me in doubt:

- 1) Would I be able to work easily in Reverse Polish Notation?
- 2) Would I find it easy to handle the stack?

Both these features are unfamiliar to users of BASIC.

FORTH, Right!

I tried writing a few lines of FORTH and then doing a dry run on paper. I found I was continually scribbling long columns of figures to show what the stack should hold at each stage, often forgetting to delete items already absorbed in a computation or printed out of the stack. The obvious solution to all this tedium was a program in BASIC to do what FORTH would do — the result is this FORTH simulator program.

Make no mistake though, this is by no means a substitute for a true FORTH. It runs only one line at a time and it is *terribly* slow. The latter feature distinguishes it at once from FORTH, which is fantastically fast (one of the main reasons that I want to use it). Also, it does not do as much as FORTH.

Despite the above reservations, many readers may find this BASIC version a useful way of 'tasting and testing' the concepts of RPN and the use of a stack-oriented language. Like FORTH, it has a dictionary and you can define new words. Also like FORTH, it is threaded, in that you can define a new word using words you have already defined. One special feature of the simulator is

that it displays the stack at each stage of the operation of the program line. It does all that 'scribbling on paper' and does not make mistakes. Here, the slow running of the BASIC version is an asset, since it goes at just the right speed to let you follow what is happening as each stage is executed.

Specification

Dictionary: Holds up to 20 words, each of which can have up to 10 terms to define it. If you want more words or longer definitions, you can easily alter the DIMAW statement in line 20. If you re-define a word, the program uses only the most recent definition and ignores earlier ones. One problem with the TRS-80 is that the colon acts as a delimiter in INPUT lines, so we can not use this to introduce the 'colon definition' as in FORTH. The hash sign is used instead. Thus we can define SQUARE by the line:

```
# SQUARE DUP *
```

The terminal semicolon is not required. Apart from this, the simulator uses exactly the same operators and commands as FORTH.

Stack: Holds up to 10 values and displays all 10 in a vertical column on the screen. The screen holds up to seven print-outs of the stack. These are printed with the tops of stack level; I prefer to think of a stack in this way, with new items pushing the others down and the stack rising when top of stack (TOS) is popped. If a line requires more than seven printings of stack, execution is halted to give you a chance to look at the display. You can then instruct it to continue; printing of stacks begins again from the left of the screen replacing the lists already there. The length of stack can be increased by altering the DIMS statement in line 10. Note that the simulator has only one stack.

To keep the program short and simple there are few error-trapping routines so it is important not to make mistakes when entering lines. However, there is a 'STACK EMPTY!' message.

Arithmetic operators: The program works with positive and



negative integers and has the complete set of operators: +, -, / and *.

Stack operators: DUP, SWAP, OVER, ROT and DROP.

Constants: You can define up to 21 of these (more if you alter DIMAC). Do not put constant definitions in a line with other instructions. The format is the standard one:

```
<value> CONSTANT <name> ...  
then press 'ENTER'
```

Variables: You can define up to 21 variables (array AV) by the format:

```
<value> VARIABLE <name> ...  
then press 'ENTER'
```

When the variable is used in a program, its address is put on top of stack followed by the letter 'V' to remind you that this is an address. The addresses are not addresses in RAM, but in the array AV, running from 0 to 20. The operator '!' (store) is usable in connection with variables.

Conditional operators: < > and =.

Conditional loops: There is one format:

```
<condition> IF <action 1> ELSE  
<action 2> THEN <continue>
```

The ELSE is *not* optional as in FORTH. If you have no 'action 2' you will need to put a dummy action in its place (eg DUP DROP). Nested loops are not provided for.

Finite loop: There is one format:
 <upper limit> <start point> DO
 <action> LOOP <continue>

When in a loop, you can obtain the value of the index by using 'I'. Nested loops are not provided for.

The above is a small subset of FORTH, but should be enough for you to try your hand at the language before deciding to go ahead and buy the real thing. Even when you have FORTH, the fact that this program displays the stack is a real help when you first begin to write your own programs.

Using The Simulator

On keying RUN, the screen is cleared and the displayed message invites you to enter a line of FORTH. Leave **one** space between all terms of the line and take care not to mis-type (do not type a space after the last term). Double-check the line, then press 'ENTER'. There will be an appreciable delay while the program runs through the string you have just entered (lines 110-180) and sorts it into individual terms which are put into array A (room for 40 terms, but you could easily extend this).

Next the program will ask for 'Command'. If you want to discard the line just entered, clear the stack and start again, type 'Q' (quit). If you want to step through the line and have the stack displayed at each step, type 'S' for 'step'. Otherwise, type any other letter and the line will

be executed as a whole, displaying the stack only at the end.

if there are more than seven steps and the screen is full, execution waits until you press any key.

When the print command (.) is used, the FORTH print-out appears on the bottom line of the screen. Subsequent print-outs will appear on the same line, to the right. This is not the same format as in FORTH, but has the advantage that at the end of execution you can see your original line, the states of the stack, the FORTH responses ('OK', etc.) and print-outs, all on the screen at once.

When execution is complete, the program waits (line 330) for a key-press. If you press 'R' the program is re-run and you lose all defined words, constants, variables and the stack. If you press 'C', however, you retain everything but the stack, which is cleared. If you press any other key, you simply return to enter a new line with everything intact. This allows you to go on from line to line when trying a more extensive program.

VARIABLES

AS Array of terms of FORTH program line.

AA\$ A character taken from AS.

AC\$ Array of CONSTANTS.

AS\$ Term to be put on top of the stack.

AV\$ Array of VARIABLES.

AW\$ Array of words (DICTIONARY).

- B\$ Input commands.
- C Number of stack displays on screen.
- D Number of responses printed at bottom of screen.
- DF 'DO...LOOP' index at finish.
- DJ Value of J for 'DO'.
- DS 'DO...LOOP' index at start.
- FF Flag for function found; = 0 if not found, = 1 when found. Used in execution to indicate than an operation has been identified and executed.
- FS Flag for single-step; = 1 for single-step.
- FT Flag in 'IF...ELSE...THEN' loop; = 0 if condition is false, = 1 if true (ie FT = TOS)
- FW Flag for word found; = 1 when search of dictionary has found a word.
- J The number of the term currently being executed.
- J1 Temporary register for J in 'IF...ELSE...THEN' loops.
- K Loop counter.
- LA Number of characters in input string A\$.
- N Array of number of terms in each word in AW\$.
- NC Number of most recently defined constant defined in AC\$ (0 to 20).
- NV As above, for variables in AV\$.
- NW As above, for words, except that words are listed from location 20 downwards (20 to 0).
- SS Stack; SS(0) is TOS.
- T Number of terms in a line.
- VA ASCII value of AA\$.

Program Listing

```

10 REM ** FORTH SIMULATOR IN BASIC
20 CLEAR 2500:DEFSTR A,B,S:DEFINT C-R,T-Z:
  DIM A(40):DIM AC(20,1):DIM AV(20,1):DIM AW(20,10):
  NW=20:DIM N(10)
30 REM ** CLEAR THE STACK
40 FOR J=0 TO 9
50 S(J)=" ."
60 NEXT J
70 CLS:PRINT "ENTER LINE OF FORTH PROGRAM"
80 FOR J=0 TO 30:A(J)="" :NEXT J:T=0:C=0:D=0
90 INPUT AS
100 REM ** SEPARATE TERMS INTO LIST
110 LA=LEN(A$)
120 FOR L=1 TO LA
130 AA=MID$(A,L,1)
140 VA=ASC(MID$(A,L,1))
150 IF VA>47 AND VA<58 OR VA>64 AND VA<91 THEN
  A(T)=A(T)+AA
160 IF VA=32 THEN T=T+1
170 IF VA>41 AND VA<48 OR VA=33 OR VA=35 OR VA>59 AND
  VA<63 THEN A(T)=AA
180 NEXT L
190 REM ** READY TO PROCESS THE LINE
200 B=""
210 INPUT "COMMAND";B
220 IF B="Q" THEN 40
230 IF B="S" THEN FS=1
240 REM ** PROCESSING NEW WORDS, CONSTANTS AND
  VARIABLES
250 IF A(0)="#" THEN N(NW)=T-1:FOR K=1 TO T:
  AW(NW,K)=A(K):NEXT K:NW=NW-1:GOTO 70
260 IF A(1)="CONSTANT" THEN AC(NC,0)=A(2):
  AC(NC,1)=[SPC]+A(0):NC=NC+1:GOTO 70
270 IF A(1)="VARIABLE" THEN AV(NV,0)=A(2):
  AV(NV,1)=[SPC]+A(0):NV=NV+1:GOTO 70
280 J=C
290 GOSUB 1000
300 IF T>J THEN J=J+1:GOTO 290
310 IF FF=1 OR FW=1 THEN PRINT@960+D*8,"OK";:D=D+1
320 B=INKEY$:IF B="" THEN 320:REM ** WAITING AFTER
  PROCESSING AN INPUT
330 IF B="R" THEN RUN
340 IF B="C" THEN 30
350 GOTO 70
360 FF=0:FW=0:REM ** EXECUTING NORMAL LINES
1010 IF A(J)="IF" THEN FT=VAL(S(0)):J=J+1:AS=S(1):
  GOSUB 4000:IF FT=0 THEN GOSUB 2000
1020 IF A(J)="ELSE" AND FT=1 THEN J=J+1:GOSUB 2500
1030 IF A(J)="THEN" THEN J=J+1
1040 IF A(J)="DO" THEN DS=VAL(S(0)):DF=VAL(S(1)):
  AS=S(1):GOSUB 4000:AS=S(1):GOSUB 4000:DJ=J:RETURN
1050 IF A(J)="LOOP" AND DS<DF-1 THEN J=DJ:DS=DS+1:FF=1:
  RETURN
1060 IF A(J)="LOOP" AND DS=DF-1 THEN FF=1
1070 IF A(J)="I" THEN AS=STR$(DS):GOSUB 4000
1080 IF ASC(LEFT$(A(J),1))>47 AND ASC(LEFT$(A(J),1))<58
  THEN AS=[SPC]+A(J):GOSUB 3000
1090 IF ASC(LEFT$(A(J),1))=45 AND LEN(A(J))>1 THEN
  AS=A(J):GOSUB 3000
1100 GOSUB 7000
1110 GOSUB 8000
1120 GOSUB 9000
1130 IF FW=1 THEN RETURN
1140 IF S(0)="#" AND FF=0 THEN 6000

```

SIMULATING FORTH

```

1150 IF A(J)="." THEN PRINT@960+D*8,S(0);" OK";:D=D+1:
AS=S(1):GOSUB 4000
1160 IF A(J)="DUP" THEN AS=S(0):GOSUB 3000
1170 IF A(J)="DROP" THEN AS=S(1):GOSUB 4000
1180 IF S(1)="." AND FF=0 THEN 6000
1190 IF A(J)="+" THEN AS=STR$ (VAL(S(0))+VAL(S(1))):
GOSUB 4000
1200 IF A(J)="-" THEN AS=STR$ (VAL(S(0))-VAL(S(1))):
GOSUB 4000
1210 IF A(J)="*" THEN AS=STR$ (VAL(S(0))*VAL(S(1))):
GOSUB 4000
1220 IF A(J)="/" THEN AS=STR$ (INT(VAL(S(0))/VAL(S(1)))):
GOSUB 4000
1230 IF A(J)"<" THEN AS=" 0":IF VAL(S(0))>VAL(S(1))
THEN AS=" 1":GOSUB 4000
1240 IF A(J)">" THEN GOSUB 4000
1250 IF A(J)"<" THEN AS=" 0":IF VAL(S(0))<VAL(S(1))
THEN AS=" 1":GOSUB 4000
1260 IF A(J)">" THEN GOSUB 4000
1270 IF A(J)"=" THEN AS=" 0":IF VAL(S(0))=VAL(S(1))
THEN AS=" 1":GOSUB 4000
1280 IF A(J)"=" THEN GOSUB 4000
1290 IF A(J)"SWAP" THEN S=S(0):S(0)=S(1):S(1)=S:FF=1
1300 IF A(J)"OVER" THEN AS=S(1):GOSUB 3000
1310 IF A(J)"!" THEN AV(VAL(S(0)),1)=S(1):AS=S(1):
GOSUB 4000:AS=S(1):GOSUB 4000
1320 IF S(2)="." AND FF=0 THEN 6000
1330 IF A(J)"ROT" THEN S=S(2):S(2)=S(1):S(1)=S(0):
S(0)=S:FF=1
1340 IF FF=0 THEN PRINT@960+D*8,A(J);"?"::D=D+1
1350 IF FS=0 AND J<T THEN RETURN
1360 FOR K=0 TO 9:REM ** PRINT STACK
1370 PRINT@256+K*64+C*8,"[8 SPC]";
1380 PRINT@256+K*64+C*8,S(K);
1390 NEXT K
1400 C=C+1:IF C>7 THEN C=0:GOSUB 5000
1410 RETURN
2000 J1=J+1:REM ** EXECUTING 'IF'
2010 IF A(J1)"ELSE" THEN J=J1+1:RETURN
2020 J1=J1+1:IF J1>T THEN PRINT@960+D*8,"NO IF!";:D=D+1
2030 GOTO 2010
2500 J1=J+1:REM ** EXECUTING 'ELSE'
2510 IF A(J1)"THEN" THEN J=J1+1:RETURN
2520 J1=J1+1:IF J1>T THEN PRINT@960+D*8,"NO ELSE!";:
D=D+1
2530 GOTO 2510
3000 FOR K=9 TO 1 STEP-1:REM ** NEW TOS AND MOVE STACK
DOWN
3010 S(K)=S(K-1)
3020 NEXT K
3030 S(0)=AS
3040 FF=1
3050 RETURN
4000 S(0)=AS:REM ** NEW TOS AND MOVE STACK UP
4010 FOR K=1 TO 8
4020 S(K)=S(K+1)
4030 NEXT K
4040 S(9)=" ."
4050 FF=1
4060 RETURN
5000 IF INKEY$="" THEN 5000:REM ** SCREEN IS FULL SO WAIT
TO DISPLAY NEXT STACK
5010 RETURN
6000 PRINT@960+D*8,"STACK EMPTY!";:REM ** EMPTY STACK
ERROR
GOTO 320
6010 GOTO 320
7000 FOR K=0 TO 20:REM ** SEARCHING DICTIONARY
7010 IF A(J)=AW(K,1) THEN T=T+N(K):FW=1:FOR I=T TO
J+N(K)+1 STEP-1:A(I)=A(I-N(K)):NEXT I:FOR I=1 TO
N(K):A(J+I)=AW(K,I+1):NEXT I:RETURN
NEXT K
7020 NEXT K
7030 RETURN
8000 AS="AS":REM ** LOOKING FOR A CONSTANT
8010 FOR K=0 TO NC
8020 IF A(J)=AC(K,0) THEN AS=AC(K,1)
8030 NEXT K
8040 IF AS<>"AS" THEN GOSUB 3000
8050 RETURN
9000 AS="AS":REM ** FINDING THE ADDRESS OF A VARIABLE
9010 FOR K=0 TO NV
9020 IF A(J)=AV(K,0) THEN AS=STR$(K)+"V"
9030 NEXT K
9040 IF AS<>"AS" THEN GOSUB 3000
9050 RETURN

```

COLOUR ATOMS

COLOUR ATOM (ATM3) 197.80

ACORN ATOM Ass. 5Kram 8Krom + NEW PAL COLOUR ENCODER, 1.8A POWER SUPPLY AND 4 FREE ACORNSOFT CASSETES.

NEW COLOUR ENCODER (ATM25) 43.70
 ATM10 ATOM KIT 3Kram 8Krom 132.25
 ATM11 ATOM KIT 12Kram 8Krom 155.25
 ACORNSOFT CASSETTES UPGRADE 10.81
 BBC21 UPGRADE MODEL A to B 115.00

ELECTRONEQUIP

128 West Street, Portchester,
 Hants PO16 9XE.
 Tel: 0705-325354

VIDEO GENIE and TRS 80

THE ROM-VIDEO GENIE & TRS 80 (3 ROM Models)

Are you fed up of loading a lower case drive every time you switch on? - Want your name inside our computer - Better loading (TRS80) - Sick of bouncy keyboards-!

You need our new ROM - simply remove old - plug in new.

- 1) Firmware driver for lower case
- 2) Security code displays - (your name & post code?) - up to 21 characters
- 3) Improved tape loading
- 4) Alleviates repeating characters (key-bounce)
- 5) Checks for feature ROMS

£14.95 + VAT + P&P (80p)

FEATURE ROMS £18.95 + VAT + P&P (80p)

- A series of ROMS starting with FEATURE 'A'
- 1) Single keystroke commands e.g. Shift A - Auto etc.
 - 2) Flashing cursor (can be toggled on/off)
 - 3) Repeating characters - with delay - (toggle)
 - 4) Machine code monitor and editor
 - 5) System load and save for backing up those system Programs - uses no RAM and so can deal with a FULL 16K program

NEW

- FEATURE 'B' - extended basic
- 1) Merge - two basic programs to one
 - 2) Renumber
 - 3) Screen print
 - 4) Various basic tools PLUS
- Access and Barclaycard accepted.

Plug on for feature ROMS

Now you can simply plug on the back of your computer, insert ROM and away you go.

VG £29.95 inc. ROM A + VAT + P&P
 TRS80 £34.50 + VAT + P&P (80p)

48K RAM - internal
 TRS80 & VG £70 + VAT + P&P (80p)
 Plug in our modules. Connect three wires (VG) or five (TRS80). You are not required to piggyback chips. Keep your old RAM (or sell it!). Compatible with expansion.

LOWER CASE HARDWARE (VG & TRS80)
 Unplug two IC's, plug in two modules, connect three wires - EASY! £19.00 + VAT + P&P

BOOKS

"Disassembled Handbook for TRS80" - A Self Teach - Series of Books - Written by Bob Richardson of New York. Very well received by U.S. Reviewers, Essential Reading for TRS80, Video Genie & Radio Hams.
 Vol. 1 Decoding the ROM & Calls, etc. £6.45
 Vol. 2 Using Calls, to shorten programs, etc. £8.75
 Vol. 3 D/A - AD, Spooling, etc. £10.50
 Vol. 4 Teletype, Morse Techniques 14.50
 Vol. 5 Voice Systems TBA

+ Much else in each volume.
 Various Books - Lists on application.
 + VG - Expansion - Disk Drives - Printers, etc.
 Details on application.

Try This:

M x 80T
 £285 + CARR. + VAT (Cash/Chq. only)
 M x 80 FT II
 £345 + CARR. + VAT (Cash/Chq. only)

LNW PCB's & Full Manuals

High Res. Colour Computer
 £108 (+ CARR. + VAT) Inc. Level 2 & Colour Roms.
 Expansion (RS232-MEM-PRINTER-DISK-CLOCK) £85 (+ CARR. + VAT)

TANTEL Prestel Adaptor (colour)
 £160 + CARR. + VAT

General Northern Microcomputers (GNOMIC)

46 Middle Street, Blackhall, Hartlepool, Cleveland. Tel. Peterlee (0783) 863871

Subscriptions

Are you looking for a more personal approach to computing? You are . . . then Computing Today is the magazine for you! Packed full of feature articles, projects, general topics, news and reviews, Computing Today is aimed at readers who want to get more out of their microcomputer.

The latest ABC circulation figures show Computing Today has increased its readership by 85% over the previous year — great news for us at CT. However, the ever increasing demand for Computing Today has meant that, despite our printing more each month, some readers seem to be missing out on their regular copy.

If you would like to ensure a regular supply for the next twelve months, each issue lovingly wrapped and posted to you, nothing could be simpler. Just fill in the form below, cut it out and send it with your cheque or Postal Order (made payable to ASP Ltd) to:

**Computing Today Subscriptions,
513 London Road,
Thornton Heath,
Surrey CR4 6AR.**

Alternatively you can pay by Access or Barclaycard in which case simply fill in your card number, sign the form and send it off. Do NOT send your card.

Do yourself a favour, make 1982 the year you start to take Computing Today every month and we'll give you a truly

Personal Approach To Microcomputing.

SUBSCRIPTION ORDER FORM

Cut out and SEND TO :
Computing Today Subscriptions
**513, LONDON ROAD,
THORNTON HEATH,
SURREY,
ENGLAND.**

Please commence my personal subscription to Computing Today with the issue.

SUBSCRIPTION RATES
(tick as appropriate)

- £11.50 for 12 issues U.K.
- £15.15 for 12 issues overseas surface
- £34.75 for 12 issues Overseas Air Mail

I am enclosing my (delete as necessary)
Cheque/Postal Order/International Money
Order for £.
(made payable to A S P Ltd)
OR
Debit my Access/Barclaycard*
(*delete as necessary)



Please use BLOCK CAPITALS and include post codes.

Name (Mr/Mrs/Miss)
delete accordingly

Address

.

.

Signature

Date

Every week, millions of advertisements appear in the press, on posters and in the cinema.

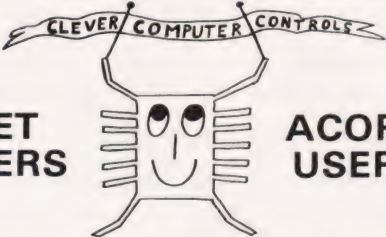
Most of them comply with the rules contained in the British Code of Advertising Practice and are legal, decent, honest and truthful.

But if you find one that, in your opinion, is wrong in some way, please write to us at the address below.

We would like you to help us keep advertising up to standard.

The Advertising Standards Authority. ✓
If an advertisement is wrong, we're here to put it right.

A.S.A. Ltd, Brook House, Torrington Place, London WC1E 7HN.



PET USERS **ACORN USERS**

**TIRED OF SLOW TAPE STORAGE?
 CAN'T AFFORD EXPENSIVE DISC SYSTEMS?**

YOU NEED NEW FLEXIROM

4k CMOS MEMORY BOARD WITH BATTERY BACK UP ONLY £39.50

- ★ STORE DATA OR PROGRAMS IN **FLEXIROM** FOR YEARS OR REPROGRAM IN SECONDS AT A FLICK OF A SWITCH
- ★ EASILY PLUGS INTO 4k EPROM SOCKET OF EITHER PET OR ACORN COMPUTERS VIA DIP RIBBON CABLE (PROVIDED)
- ★ SINGLE LEAD CONNECTION FOR R/W SIGNAL
- ★ QUICKER THAN TAPE OR DISC SYSTEMS
- ★ HIGH QUALITY PCB SWITCH ALLOWS QUICK CHANGING BETWEEN RAM AND ROM.
- ★ ON BOARD BATTERY IS TRICKLE CHARGED WHEN **FLEXIROM** IS USED.
- ★ LED INDICATES WHEN **FLEXIROM** IS IN RAM MODE
- ★ **FLEXIROM** CAN BE UNPLUGGED WITHOUT ANY LOSS OF DATA

INCREDIBLE VALUE 8 WAY EPROM SOCKET EXPANDER ONLY £34.95

- ★ IDEAL FOR PET ACORN OR ANY COMPUTER WITH A 4k EPROM SOCKET
- ★ CHOOSE BETWEEN 8 EPROMS/ROMS/FLEXIROMS FROM JUST ONE SOCKET
- ★ PLUGS INTO 4k EPROM SOCKET VIA DIP RIBBON CABLE (PROVIDED)
- ★ PCB SWITCH ALLOWS EASY SELECTION OF ANY ONE EPROM SOCKET

NEW SERVICES FOR ACORN USERS. LET US STORE YOUR **BASIC, PROGRAMS** IN EPROM -

- ★ SEND US A TAPE OF YOUR FAVOURITE BASIC PROGRAM AND WE WILL PROGRAM THEM INTO YOUR OWN PERSONAL EPROM COMPLETE WITH DIRECTORY
- ★ LINK - A000 PRODUCES AN INSTANT DIRECTORY LISTING THEN JUST TYPE NAME OF PROGRAM YOU REQUIRE AND IT WILL RUN INSTANTLY
- ★ PLUGS INTO UTILITY ROM SOCKET OR EPROM EXPANDER.
- ★ IDEAL FOR GAMES AND BUSINESS

Total price including 4K Eprom (2532) £795.
 Any number of programs can be saved providing total length is less than 3.5K bytes
 Please include list of program names with your tape.

**CLEVER COMPUTER CONTROLS CLAYCOURT
 LOWER HARDRES, CANTERBURY, KENT. TEL. NO. PETHAM 644**

WHY YOU NEED THE INSPECTOR.

If you're serious about programming, you need to set all your utilities together in one place — *inside* your Apple. The Inspector comes on an Eprom that simply plugs into the D8 socket, or on a disk ready to merge with Integer Basic for automatic loading on boot. Either way, it stays at your fingertips, ready to call without disturbing your current program.

The Inspector puts you in total control of both memory and disks. You can search forward and backwards, edit, read nibbles, map disk space, dump the screen to a printer, examine every secret of your Apple. Use The Inspector to repair blown disks, undelete files, input "illegal" commands,

read and alter files, locate strings in memory or on disk. The uses are endless. The manual, alone, is an education. And it's always *there* when you need it.

You need the most powerful disk and memory utility available for your Apple. You need the Inspector.

See your local dealer, or order direct for just £45.00. Access or Visa accepted. Add £1.50 P & P. VAT excluded.



DDP RESEARCH & MARKETING

17 NOBEL SQ. BASILDON
 ESSEX SS13 1LP
 TEL: (0268) 728484

Apple is a registered trademark of Apple Computer, Inc.

In this, the second part of our series on interfacing, we take a look at the art of economising on I/O lines.

In last month's article all the assumptions were based on the schematic outline of Fig. 1 (see the April issue), which defined a system based on only one input and one output. Many practical systems, however, may require many such inputs controlled by one computer.

Because we are dealing with a number of analogue inputs it is obviously going to be more efficient to select which of these is fed to the A to D converter than to select which of a number of A to D converters we connect to the computer - it's going to be a lot cheaper too! The converse applies to the output side as well, of course.

The devices we are going to look at belong to a family known as multiplexers and although they are digitally controlled, they switch analogue signals. A multiplexer allows a number of inputs - how many depends on the specific device chosen - to be selected in order. The reverse function is performed by a de-multiplexer.

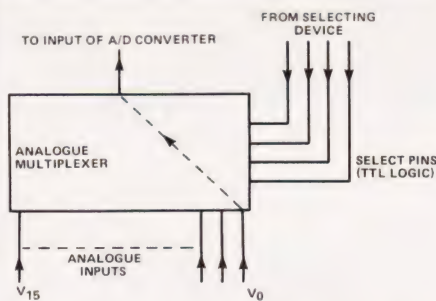


Fig. 4. Typical pin functions of a 16-way analogue multiplexer.

Multiple Connections

The functions of a typical 16-way multiplexer are shown in Fig. 4. Any of the analogue inputs can be selected by setting the appropriate binary code on the four select pins. For example, the code 0011 would select the input V_3 . The controller for the multiplexer is often part of the computer, indeed it may even be the computer, or it can be a separate 'black box'.

Figure 5 shows the functional arrangement of a 16-way de-multiplexer and this works in exactly the reverse fashion to the multiplexer in that the code selected determines which of the outputs the signal appears on.

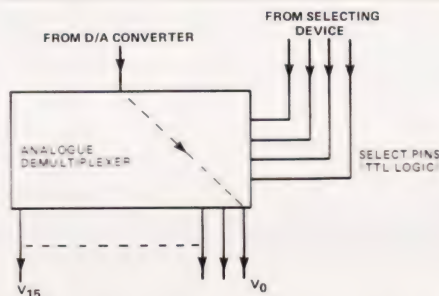


Fig. 5. Typical pin functions of a 16-way analogue de-multiplexer.

Warm Or Golden?

The number of lines available on input/output devices is often limited. Many systems provide the eight data lines and two control lines; often referred to as handshake lines. If you refer to last month's article, the two lines 'sample' and 'valid' shown in Fig. 2 would have been connected as handshake lines.

Although this limitation is often built-in when you buy the system, there is often no reason why the number of I/O lines cannot be expanded, provided of course there are spare addresses in the memory map. Indeed, many of the microcomputer manufacturers offer extra I/O cards for just these purposes.

Once you start to look at the limitations, however, it is often surprising to find how much you can do with the limited facilities provided. Devices such as counters and shift registers often come in very useful and Fig. 6 shows one possible solution. The software needed to operate this could commence with the counter set to zero; resetting on power-up being the logical method. With the counter at zero, input V_0 is selected and appears at the input to the A to D converter. Nothing will now happen until the computer sets the handshake line connected to the sample input of the A to D. When the valid line changes state the computer can read the data and store it at a convenient location in memory. A pulse is now sent to the counter which causes the next input line to be selected. How this pulse is derived depends on the system you have available but it could be achieved by delaying the valid pulse by an amount sufficient to read the data into the computer and then using it to generate the clock for the counter.

This process will now continue until the counter reaches 16 at which point the counter will have to be reset and the process started all over again.

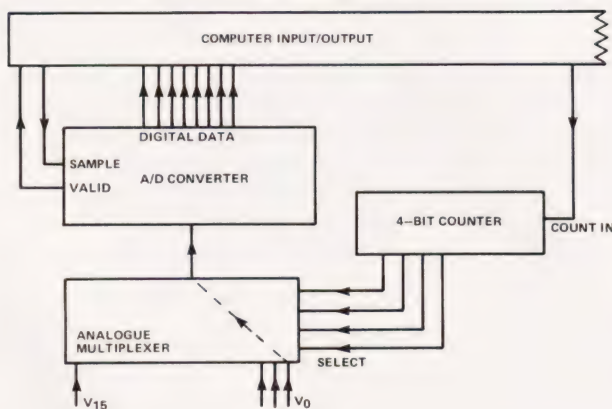


Fig. 6. Handling the multiplexer.

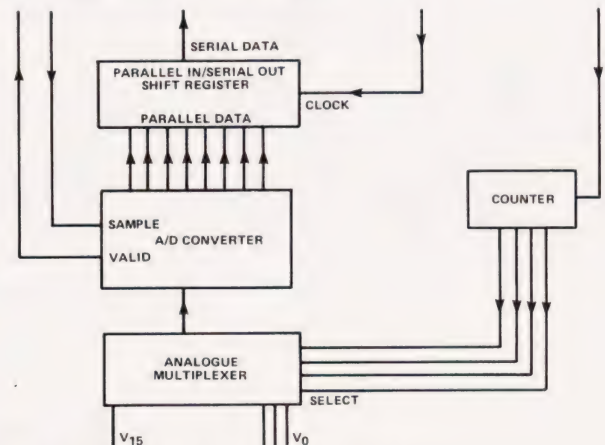


Fig. 7. Using a shift register to serialise data.

CONNECTIONS

Bit By Bit

It is possible to make even less demand on the number of I/O lines by using a shift register to convert the parallel output of the A to D converter to a serial bit-stream which only uses one data line. Figure 7 illustrates this. The cycle of operations is fundamentally the same as that described for the last example except that the shift register is supplied with a clock signal converting the parallel data from the A to D into a serial bit-stream.

The process is, of course, slower than the previous method because each byte delivered by the A to D will require eight clock pulses to feed it into the computer. The saving in the number of I/O lines tied up is substantial though.

It must be emphasised that all these examples are simply schematic representations of the processes involved and cannot be taken as working models. To implement them in hardware will require specific information on the various devices and data sheets and applications notes should be consulted.

Switches And Relays

Many applications of computer control do not involve A to D or D to A conversion techniques. Often, the computer is merely required to sense whether a particular switch is on or off. Similarly, the system may be required to operate switches at various locations and, because the voltages being controlled are greater than those used within the computer, some form of isolation must be used. Various options exist and are in common usage.

Reed Relays: These are very popular and can be obtained in a variety of forms including DIL packaging. Figure 8 shows the construction of a typical device of this type. Their action is similar to a more conventional type of relay but

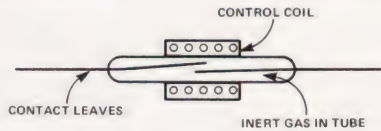


Fig. 8. A sectional view of a reed relay.

they can generally be made much smaller. The operating coil only requires a small current and may be driven directly from the computer; special TTL compatible types are generally available. It is essential to place a reverse biased diode across the coil otherwise the back emf generated when the coil is turned off may damage the driving IC.

Opto Isolators: These act as almost 'perfect' relays and are becoming very popular as isolating components. Figure 9 illustrates the various functions.

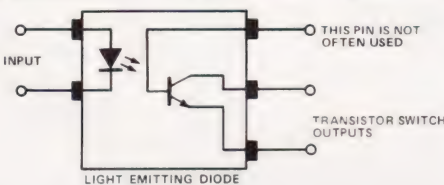


Fig. 9. An opto-isolator.

A small current flowing through the LED causes light to fall on to the base of the phototransistor and this allows current to flow from the collector and emitter. There is complete DC isolation between the two halves of the device and they can be driven directly from TTL levels. Because the transistor is a small device it can only carry a low current so in many cases a second transistor will be used to drive the final load.

A further use for opto isolators is as a terminating device on long lines. Logic devices can often suffer from the effects of RFI picked up by long cable runs acting as aerials; terminating lines of this type with a load can often reduce the effects.

A practical circuit for driving a 24 V DC motor under computer control is given in Fig. 10. The system is using negative logic so the output from the computer must go low to turn the motor on. The reverse biased diode across the motor is present for the same reasons as the one across the relay that was mentioned earlier. We are also using a pair of transistors in this example to boost the current carrying capacity of the photo transistor — we could not simply use the photo transistor as it would be burnt out.

Driving mains voltages is something that should be undertaken with care and opto isolators again prove their worth in this area. Figure 11 shows a practical example which will control a 0.5 kW load. Notice that there is no electrical connection at all between the 5 V logic circuitry and the 240 V AC mains, it's all done by light!

The computer can turn on the mains device by setting the output line high causing the phototransistor to conduct. This turns on the gate of the triac and, in turn, causes the triac to conduct thus turning on the load. The resistor and capacitor across the triac act as a 'snubber' network and prevent false triggering.

Higher powered opto isolators are also available using a Darlington pair transistor configuration (Fig. 12 shows an example) and they are also available in sets of four, Fig. 13.

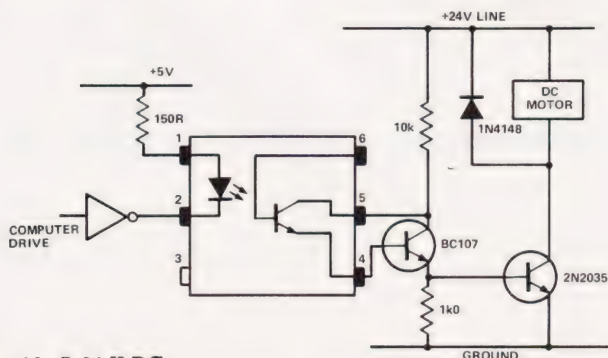


Fig. 10. A 24 V DC motor.

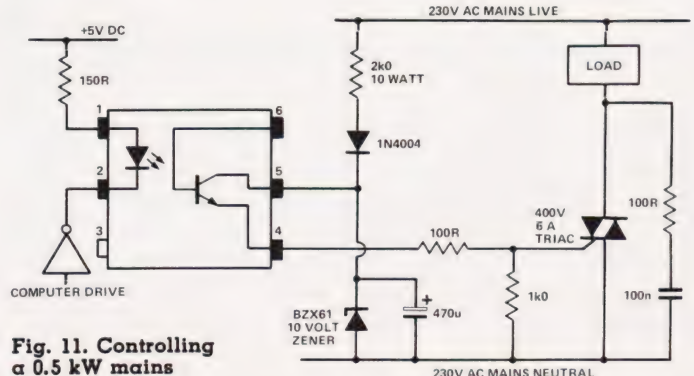


Fig. 11. Controlling a 0.5 kW mains load.

Fig. 12. A Darlington opto-isolator.

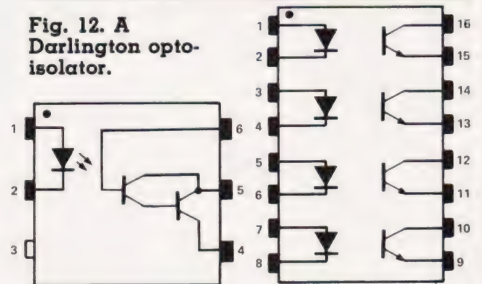


Fig. 13. A quad opto-isolator.

ZX81

ZXTM

Programmers toolkit for the ZX81, containing many powerful aids, including:-

- ★ Full renumbering (including GOTO'S and GSUB'S)
- ★ Read filenames from tape
- ★ Checksum
- ★ Transfer basic lines above rantop - Allows you to merge basic programs
- ★ Block copy and delete on basic lines
- ★ Create rem statements of any length

These are just some of the features. Full documentation included. price £6.00 inclusive.

ZXAS

The one and only ZX81 assembler- Thousands sold - Assembles all 200 mnemonics - Full instructions included. ONLY £5.00.

ZXOB

Machine code debugging program including a full disassembler and much more. May be used in conjunction with ZXAS. ONLY £6.50.

FREE

INVADERS
(normally £4.00)

WITH ORDERS OVER £20.00

SPECIAL OFFER

ZXAS + ZXDS + ZXTM £15.00.

DICTATOR £9.00
 STARTREK £5.00
 DAMSEL and BEAST £6.50

SPECIAL OFFER

ALL 3 FOR £17.

MULTIFILE £17.50. WHIST £4.00
 CONSTELLATION £8.00

ALL PROGRAM PACKS (1-7)
 NOW £4.00
 ANY THREE FOR £10.00

B.B.C. MICRO



THE BEEBON.
A new magazine dedicated exclusively to the users of the B.B.C. Micro.

The Beebon contains useful programs, features on programming, special offers, reviews and much more. Full instructions are two months available in May. Annual subscription £10.00 (inc. postage).

SPACE WAR. The ultimate Star Trek type game - High resolution colour graphics, sound and real time. Probably the most sophisticated Trek type game. Supplied complete with a sixteen page manual and function key labels. PRICE £11.50 inclusive.

BACKGAMMON. A standard Backgammon game, with extremely fast computer responses. Playing instructions are included. PRICE £8.00.

CHESS. A fast version with many levels of play, using high resolution display. There are many options, including setting up, saving games on tape, changing level of play, castling and "en passant". Plays a very strong game. PRICE £11.50 inclusive.

GOLF. A very true to life simulation of an eighteen hole course. Complete with fairways, bunkers, greens and streams. Altogether a very compulsive game. PRICE £7.00 inclusive.

MULTIFILE. A multi-purpose filing system, with user definable set up. It caters for all file handling, including modifying, fast search, extensive calculation facilities and more. PRICE £25.00 inclusive.

BUG - BYTE

SOFTWARE

ATOM

CHESS
Fantastic machine code game for the 12K Atom. Features include: (high res. + alphanumerics), many levels of play. Supplied on cassette with instructions. PRICE ONLY £9.00



INVADERS

"The best excuse to expand your Atom. It is a superb version of the standard game, tough and fast" Your Computer Nov '81 12K graphics mode -. ONLY £8.00

747

Written for Bug-Byte by a 747 pilot. Accurate simulation of a 747's cockpit display (airspeed, altitude, rate of climb, attitude, flaps etc., and graphic display of horizontal situation and attitude); allows you to guide your craft to the landing strip. On making your final approach the display changes to a high resolution 3D representation of the runway coming up to meet you. A real test of skill. Finding the runway is quite a challenge - landing safely is even more of a challenge. If you succeed, you are awarded a skill rating and the chance to take off and try again. Requires Floating Point ROM. PRICE ONLY £8.00

GALAXIAN

Fantastic high-resolution (mode 4) arcade game, with fast swooping aliens, excellent sound effects, and high score. 12K PRICE £8.00

SPECIAL OFFER

ALL FOUR FOR £35.00!

| | | |
|--------------------|--------------------|---------------------|
| FINBALL £4.50 | BREAKOUT £4.00 | FRUIT MACHINE £4.00 |
| LUNAR LANDER £5.50 | GOLF £5.00 | BACKGAMMON £7.00 |
| STAR TREK £5.00 | DISASSEMBLER £4.00 | |

VIC

VICMEN

A full feature version of the popular "Puckman" arcade game for the UNEXPANDED VIC. Written entirely in machine-code for fast action. PRICE £7.00



BACKGAMMON

Standard Backgammon game for the VIC with W expansion. Rapid computer responses. Full instructions included. PRICE £7.00



ANOTHER VIC IN THE WALL

A machine code Breakout game for the unexpanded VIC. PRICE £7.00

ASTEROIDS

Fantastic machine code Arcade game for the unexpanded VIC. PRICE £7.00



GENEROUS DISCOUNT AVAILABLE FOR DEALERS - PHONE FOR DETAILS



PLEASE SUPPLY:

NAME:

ADDRESS:

I ENCLOSE A CHEQUE/POSTAL ORDER

OR PLEASE DEBIT MY ACCESS/BARCLAYCARD NUMBER

SIGNATURE:

100 THE ALBANY, OLD HALL STREET, LIVERPOOL L3 9EH.

BUY ATOM LISP and discover artificial intelligence

Essential for :

- * students learning LISP
- * research
- * hobbyists interested in artificial intelligence
- * systems designers.

ATOM LISP is an interpreter for the language LISP consisting of 5½K of machine - code interpreter plus 2K of initialised LISP utilities and constants which can be deleted if not required.

Important Features

- fully interactive with explicit EVALUATE and VALUE IS messages
- automatic parenthesis count
- SUPERPRINT to format the printing of large expressions
- screen editing or built-in LISP editor
- errors trapped and optional full traceback printed.

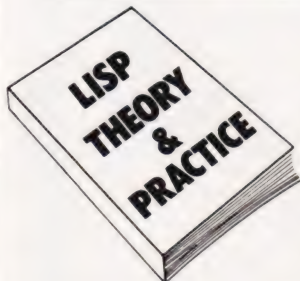
ATOM LISP includes a number of extensions to basic LISP, including:

- PEEK, POKE and CALL to control hardware and machine-code programs
- functions can have optional arguments with default values
- improved interactive control structures using LOOP, WHILE and UNTIL functions
- automatic access to COS or DOS commands
- cassette (or disk) input/output control.

The fast compacting garbage collector automatically finds space for numbers, lists, or character strings if there is any space at all remaining. This means that the programmer never need be concerned about the details of storage allocation.

LISP Functions

AND, APPLY, ATOM, BLANK, CALL, CAR, CDR, CAAR, CADR, CDAR, CDDR, CHARP, CHARS, CLOSE, COND, CONS, CR, DEFUN, DIFFERENCE, DOLLAR, EDIT, EQ, ERROR, ERRORSET, EVAL, F, FSUBRP, GET, GETCHAR, GREATERP, LAMBDA, LESSP, LIST, LISTP, LOAD, LOOP, LPAR, MESSOFF, MESSON, MINUS, NIL, NOT, NULL, NUMBERP, OBLIST, OPEN, OR, ORDINAL, PEEK, PERIOD, PLIST, PLUS, POKE, PRINO, PRINT, PROG, PUT, QUOTE, QUOTIENT, READ, READLINE, RECLAIM, REMAINDER, REMPROP, RPAR, RPLACA, REPLACD, SAVE, SET, SETQ, SUBRP, SUPERPRINT, SUPERVISOR, T, TIMES, UNDEFINED, UNTIL, WHILE, WRITE, WRITEO, ZEROP.



ATOM LISP is available on cassette at only £17.25 inc VAT from your Acorn dealer or direct from Acornsoft. Accompanying 44 page instruction manual "Lisp Theory and Practice" available for £6 (no VAT).

All Acornsoft products are available from authorised Acorn dealers or can be ordered direct from Acornsoft Ltd. 4A Market Hill, Cambridge CB2 3NJ.

Credit card holders can ring 0223 - 316039 and place their orders direct.

ACORNSOFT

/// 'make it easy on yourself' ///

COMPLETE LAB MADE IN ENGLAND INTERFACING FOR YOUR APPLE

- 8ch. 12 bit A/D
- + 32 parallel I/O
- + Timer

all
for
only **£350.00**

The U-A/D is your connection to a wide variety of instruments and equipment at a price half you'd pay for separate boards for each function

Available from Apple Dealers worldwide or direct from U-Microcomputers.

Prices do not include VAT or p. & p. (£1.00 per board)

U-Microcomputers Limited,
Winstanley Industrial Estate,
Long Lane, Warrington,
Cheshire, WA2 8PR, England.
Telephone: 0925 54117/8
Telefax: 668920 U-ONE



U-MICROCOMPUTERS

a range of quality peripheral cards to enhance your Apple

We now make
more Apple cards than Apple!

/// // // // // // // // // // // // // // // //

BBC SOFTWARE

WORDWISE — THE WORD PROCESSOR for the BBC Micro — A professionally written program supplied in ROM, containing all the usual word processor facilities plus several unusual ones like a fully automatic word count. Extremely fast and very simple to use, a powerful piece of software. Supplied with a full manual for £65 + £1.50 p&p + VAT.

SNAKE — This highly addictive game for the model B makes full use of the amazing graphics and sound facilities of the BBC Micro, it will give hours of fun. Supplied on a quality cassette for £5.80 + VAT.

RAM KITS. Upgrade the model A to 32K RAM — supplied with full instructions for £29.90 + VAT.

CASH or royalties waiting for any interesting software for the BBC machine. The better the program the more we will pay.

Send an SAE at least 6" by 9" for latest details of our software and to get your name on our mailing list. Please add VAT to all prices. Mail order only.



Dept CT6
16 Wayside
Chipperfield
Herts WD4 9JJ
Tel. (09277) 62955

MICROCOMPUTER COMPONENTS LOWEST PRICES - FASTEST DELIVERY

MEMORIES — SPECIAL OFFER

| | | | |
|--------------------------|-------------|----------------------|--------------|
| 2114 LOW POWER 200ns | 0.84 | 4118 150ns | 6.00 |
| 2114 LOW POWER 300ns | 0.84 | 4118 200ns | 9.90 |
| 2716 450ns (Single + 5V) | 1.95 | 5516 200ns | 9.75 |
| 2532 450ns | 4.20 | 6116 LOW POWER 150ns | 10.83 |
| 2732 450ns | 4.00 | 6116 LOW POWER 200ns | 10.00 |
| 4116 150ns | 0.84 | 6116 150ns | 5.25 |
| 4116 200ns | 0.70 | 6116 200ns | 4.95 |

BBC MICRO — UPGRADE KITS

| Part No | Description | Price Each |
|--|--|--------------|
| BBC 1 | 16k Memory Upgrade Kit | 32.00 |
| BBC 2 | Printer/User I/O Kit | 9.50 |
| BBC 3 | Floppy Disc Controller Kit | 42.50 |
| BBC 4 | Analogue Input Kit | 9.50 |
| BBC 5 | Serial Interface and RGB Connector Kit | 11.45 |
| BBC 6 | Expansion Bus and 'Tube' Kit | 6.95 |
| Special price for all kits purchased together (Converts Model A to Mode B) | | 99.95 |

OFFICIAL
ORDERS
WELCOME



24 HOUR TELEPHONE SERVICE FOR
CREDIT CARD USERS



QUANTITY
DISCOUNTS
AVAILABLE

- ★ Free Reply Paid Envelope with every order ★
- ★ All CWO's receive a voucher value £1 against future purchases ★
- ★ All prices exclude VAT & P & P (0.75) (Free on CWO's over £10) ★
- ★ All orders despatched on day of receipt with full refund on out of stock items if requested ★

MIDWICH COMPUTER CO. LTD.
DEPT CT, HEWITT HOUSE, NORTHGATE STREET,
BURY ST. EDMUNDS, SUFFOLK IP33 1HQ
TELEPHONE: (0284) 701321 TELEX: 817670

HENRY'S

COMPUTER KIT
DIVISION

TANGERINE COMPUTER SYSTEMS
LONDON & HOME COUNTIES STOCKISTS

ALL PRE-PAID
ORDERS
POST FREE

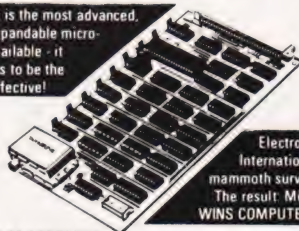
RETAIL SALES
AND DEMONSTRATIONS

404 EDGWARE RD. LONDON, W2 1ED TEL: 01-402 6822

TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE

MICROTAN 65

Microtan 65 is the most advanced, powerful, expandable micro-computer available - it also happens to be the most cost effective!



Electronic Today International held a mammoth survey of kits. The result: Microtan 65 WINS COMPUTER CLASS!

MICROTAN 65 CONTENTS

High quality, plated thru hole printed circuit board, solder resist and silk screened component identification. 6502 microprocessor 1K monitor TANBUG Now with 'V' Bug 1K RAM for user programme, stack and display memory VDU alphanumeric display of 16 rows by 32 characters MICROTAN 65 system file binder 136 page, bound, users hardware / software manual with constructional details and sample programmes Logic and discrete components to fully expand MICROTAN 65

KIT FORM **£69.00** + V A T

MICROTAN 65 assembled and tested. Specification as above, but assembled and fully bench tested by ourselves **£79.00** + £11.85 V A T, total £90.85

71 KEY ASCII KEYBOARD £69.95 Incl.
NO EXTRAS NEEDED

Uses gold crosspoint keys. Includes numeric keypad and ribbon cable Available as fully assembled and tested

SUPER METAL CABINET IN TANGERINE - BLACK **£20.00** + V A T £3.00 total £23.00



PROFESSIONAL ASCII KEYBOARDS Ideal for Tangerine

£29.95 + V A T

- 52 key 7 bit ASCII coded
- Positive strobe +5V-12V
- Full ASCII characters
- Parallel output with strobe
- Power light on control
- Chip by General Instrument (G I) TTL output



- Superbly made
- Size 13 x 5.5 x 1.5 ins
- Black keys with white ledgens
- Escape shift return & reset keys
- Control repeat & bell
- Complete with DATA

ADD-ON KEYPAD



A compact 12 button keypad suitable for use with above keyboard to extend its functions plus four extra keys. Supplied brand new with with data A 4x4 non-encoded single mode keyboard

LIST PRICE
£22.00
OUR PRICE
£7.95
+ V A T

NEW MICROTANTEL POST OFFICE APPROVED PRESTEL - VIEWDATA

- FULL COLOUR GRAPHICS • MICROTAN OWNERS CAN COMMUNICATE WITH EACH OTHER • CAN STORE PRESTEL • CAN BE USED AS AN EDITING TERMINAL • CAN BE INTERFACED WITH PET, APPLE etc

Just connect to the aerial socket of any colour or black and white domestic T.V. receiver and to your Post Office installed jack socket and you are into the exciting world of PRESTEL. Via simple push button use you are able to view 170,000 pages of up to the minute information on many services, order goods from companies - all this without leaving your armchair!



£170
+ V A T

TANEX £43.00

Minimum
Config Kit

CONTENTS

High quality plated thru hole printed circuit board, solder resist and silk screened component identification I.C. sockets for maximum expansion 64 Way D I N edge connector 1K RAM, cassette interface, 16 parallel I/O lines, a T.T.L. serial I/O port, two 16 bit counter timers, data bus buffering, memory mapping, logic and discrete components for maximum expansion TANEX users manual.

TANEX (Minimum configuration) Assembled **£53.00** + V A T £7.95, total £60.95



TANRAM

AVAILABLE NOW TANRAM - 40K Bytes on one board! 12 slot SYSTEM MOTHERBOARD, supports 277K Bytes SERIAL & PARALLEL I/O boards. High Definition COLOUR GRAPHICS Single board of bulk memory offering 7K Static RAM (2114), and 32K Dynamic RAM (4116). Onboard refresh is totally transparent to CPU operation and is unaffected by normal DMA's. TANRAM fully expands the available address space of the 6502 microprocessor MICROTAN, TANEX and TANRAM together provide 16K RAM, 48K RAM, and 1K I/O - that's a lot of memory and a lot of I/O! Built and tested TANRAM ASSEMBLED



40K RAM CARD with 16K DYNAMIC RAM £76 - V A T

CONTENTS: High quality plated thru hole printed circuit board, solder resist and silk screened component identification Full complement of I.C. sockets for maximum expansion 64 way D I N edge connector 1K RAM (2114) Data bus buffering TANRAM users manual

EXTRA RAM:

1K STATIC (2114) £2.95 each 16K DYNAMIC (4116) £1.50 each

TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE • TANGERINE

Stockist Enquiries on headed notepaper to:
COMPUTER KIT LTD. (Principal Distributors in U.K.)
11/12 Paddington Green, London, W2. Tele: 01-723 5095
Telex 262284 Ref. 1400 TRANSONICS

All orders pre-paid and official advertised here and elsewhere
in this magazine by TANGERINE to be forwarded DIRECTLY to
COMPUTER DEPT., 11/12 PADDINGTON GREEN, LONDON W2

SEND FOR
FREE BROCHURE

Dear Sir,

I see from your April edition that the May issue is to include an article on what to expect next from the BBC and the manufacturers of the BBC Micro.

Please do not let anyone repeat the myth that the backlog of orders has been almost overcome. Some of your competitors have let it be known that the back order positions will be up to date by the end of March.

I recently enquired about my own order and was told that if I ordered in mid-January (which I did) I should receive my microcomputer some time in May. It seems that the problems are far from overcome and, presumably, anyone ordering now can expect to wait until June or July. It would be helpful to your readers if you could publish the true current position.

Your faithfully,
T G R Lawrence
London

(*By now I hope that you have read our feature on the BBC apres-le-series part one. I would hardly describe our comments on the state of play delivery-wise as being over-optimistic!! Ed*)

Dear Sir,

I think that British computer magazines are better than the ones available here in the US. When I left London to move to Colorado, I bought a subscription to CT because it was a very good, all round magazine (and quite affordable). However, I am sorry to say that the quality of the content and organisation of the magazine has declined in the past few months. The technical articles are now far too technical (some too difficult to follow — some just plain useless), and the beginner's articles seem to be aimed at the simpleton. 1980 and 1981 were your best years ever.

Of course, this is just my opinion, many people must be delighted with the new format. #File is an excellent added feature which will probably grow into your best regular feature.

Yours sincerely,
Darius Ragheb
Colorado, USA

PS Don't get too hung up about the BBC machine.

(*I trust that your distance from the UK market, for which our magazine is primarily intended, and your close proximity to the US market, which is, to say the least, somewhat differently oriented has not clouded your judgement. Nevertheless, your opinion is valued and anyone else with a similar view should write and let us know. After all, what point is there in us slaving away to produce this magazine if we aren't filling it with what you want to read? Ed*)

Dear Sir,

Beginners who have struggled through their provisional copies of the User's Guide for the Proton (*I think he means BBC Micro. Ed*) may be a little mystified about the colours in Teletext mode (MODE 7). A 'phone call to Acorn provided the information that a control code in the region of 82 Hex (130 decimal) was required.

A little experimentation produced the following results: if a string is preceded by a CHR\$(X) statement, it will be printed in colour (if the colour is followed by CHR\$(88), the output will be a flashing colour) when X has the values give below.

| Hex | Dec | Colour |
|-----|-----|------------|
| 81 | 129 | Red |
| 82 | 130 | Green |
| 83 | 131 | Yellow |
| 84 | 132 | Blue |
| 85 | 133 | Magenta |
| 86 | 134 | Cyan |
| 87 | 135 | White |
| 88 | 136 | (Flashing) |

Large characters can be generated using CHR\$(141). However, since these letters need two lines, the commands must be given twice:

```
10 PRINT CHR$(141) "DOUBLE SIZE"
   CHR$(141) "DOUBLE SIZE"
```

The first occurrence of CHR\$(141) prints the top halves of the letters, the second occurrence prints the bottom halves. In fact, the two strings need not be the same, which can produce some interesting effects!

These can be 'stringed' together:

```
20 PRINT CHR$(130) CHR$(136)
   CHR$(141) "TELETEXT" CHR$(130)
   CHR$(136) CHR$(141) "TELETEXT"
```

This will produce the word 'TELETEXT' in large green flashing letters. Changing the codes will

make the two halves different colours.

Yours faithfully,
Carl Zetie
Maidenhead

Dear Sir,

Firstly, I must congratulate you on the consistent good quality of your magazine, providing useful information and well-debugged programs (unlike 'certain' others). Even the fearsomely unreadable 'Buyers' Guides' are well worth the space, if only for their quantity of useful information.

In return for the above sample of unadulterated pluggery, I would be obliged if you would publish the information below (as well as the testimonial above).

Having read your series of articles on the language 'FORTH', I was moved to begin writing a line-by-line 'tiny' compiler with pseudo-string handling capability. However, after trying out some of my later versions, I have discovered that FORTH is far too structured for me (my programs are usually unstructured enough to curdle milk at fifty paces) and decided not to continue with it. However, rather than waste my hours of toil, I would be only too glad to tape for anyone with a Microtan 65 with more than 2K (or a micro that will load Tangerine-dumped programs) the 2½K of not-entirely-debugged code I have written. If you would like this program, please send me a cassette and an SAE to 63 London Road, Maidstone, Kent.

If anyone is in a similar situation with a Tiny BASIC interpreter, I would be most interested in a swap.

Yours faithfully,
J M Styles
Maidstone

Dear Sir,

I am writing to ask you to update your User Group Index.

The North West TRS-80 Users Group has monthly meetings, a bi-monthly newsletter, a members software library, Sub groups and more. Will exchange newsletters with any other TRS-80 users group. For more details contact:- Melvyn D Franklin, 40 Cowlees, Westhoughton, Bolton BL5 3EG. Tel:- Westhoughton (0942) 812843.

Yours faithfully,
Melvyn D F Franklin
Group Secretary

Dear Sir,

I would be very pleased if you could update the entry for the Amateur Computer Club's 2650 Library to that given below and indicate to your readership that the library is now alive and kicking once more after a short period of hibernation caused by my recent move.

Wishing you and the magazine all the best.

Yours faithfully,
Roger A Munt
Tyn-y-Coed
Kilnwood Lane
South Chailey
East Sussex BN8 6AU

Dear Sir,

We would be most obliged if you will let your readers in the Hartlepool area know that a Computer Club has been started.

The first meeting of the Club was held at the Welfare Hall For The Blind, Avenue Road, Hartlepool on Friday, 26th February, 1982.

Mr Harry Cuthbert, the Acting Chairman, and Mr David Jones, the Acting Sec., can both be contacted after 6.30pm most evenings on Hartlepool 71027 or 66001.

It is hoped that anyone who has an interest in computing will join the Club, 'non owners' are also most welcome.

Yours faithfully,
David R V Jones
Cleveland

Dear Sir,

A few month's ago I wrote to you for help with your 'Morse code' program, and 'Pools predict' program.

I wish to say thank you for your prompt and speedy reply, together with your Programming Standards enclosure.

These are both now running properly, and I can assure you that I look forward to the future copies of Computing Today.

Thanking you again, a very satisfied customer.

Yours faithfully,
I Coulson
Invergowrie

(*I think the fact that you remembered to enclose an SAE of sufficient size may well have had something to do with it! Ed*)

Dear Sir,

The superb program in your February issue for Auto Numbering on NASCOMs does, indeed, require a small change to work with NAS-SYS 3.

Unfortunately, just changing the length of the table does not work as LINVAL overwrites the repeat keyboard routine address with disastrous results.

It is necessary to change the address of the registers and 0D20 Hex for LINVAL gives a POKE address of 3360 — quite easy to remember.

The new BLINK routine is now at 0D25 Hex so 0D17 Hex requires changing to 21 25 0D and all register addresses require changing to LINVAL 0D20

INCVAl 0D22
FLAG 0D24

Yours faithfully,
A Marshall
Huddersfield

Dear Sir,

Thank you for your very comprehensive review of the BBC Microcomputer. It arrived about the time I received my computer and has been most useful. It is disappointing to find that the documentation is so incomplete and that it will, it seems, be much less comprehensive than the ATOM manual. However, we must all wait and see, I suppose.

There are a couple of hardware points mentioned in your review that do not apply to my machine: the PSU transformer is not toroidal, but is a very ordinary open frame type whose substantial stray magnetic field causes a lot of mechanical hum from the steel PSU case and is bad news for a TV tube. And, all the support and memory chips are soldered direct to the board, ie not socketed.

There is another point worth noting, and that is that the BNC connector does not provide a colour signal as specifically stated in both the BBC hardware specification and in their brochure published last summer. This is evident from the circuit on page 221 of the manual which shows that raw RGB/Sync signals are summed by transistor Q7; this has been confirmed today by a letter I have had from Acorn's Technical Department. It means that colour monitors requiring a PAL-encoded composite video signal, such as

the TV sets with a video tape recorder input that are now coming on the market, will provide only a B/W picture. Acorn also confirm, incidentally, that the firmware in EPROMs will be replaced eventually by ROM 'as soon as possible' but can give no idea when.

Finally, I have had the power supply cut out on a few occasions after about one or two hours' use. The PSU runs extremely hot (I've roughly measured 62 °C) so that may be the cause as all seems to be well after switching off for five or 10 minutes. I would like to hear whether you or any other user has had a similar problem.

I hope all that does not sound churlish when Acorn and the BBC have given us such a splendid machine — it has taken a little of the gilt off the gingerbread, though!

Yours sincerely,
Brian Carroll
Aldershot

(*To set your mind at rest over a couple of points, you might be interested to hear that the new User Guide is very, very good indeed. By the time it is bound, hopefully in a spiral or ring binder, it will be some 500 pages long and represents an excellent piece of documentation. It will also be supported by a number of specialist interest manuals for the Assembler and a couple of the more esoteric and advanced functions.

The monitor drive from the BNC is black & white, as expected... however, there is an RGB output which gives a much higher picture quality than a composite signal.

The ROM-based firmware will not be released until the DOS is up and running, see 'Aftermath' in the last issue. Ed*)

Dear Sir,

This letter is to introduce myself as the Public Relations Officer for the East London Amateur Computer Club.

The Club meets at the Harrow Green Library, Cathall Road, Leytonstone, London E11. We meet on the second and fourth Tuesday of each month. The first meeting is a lecture meeting, and we try to obtain people from

outside the Club. The second meeting is usually a talk-in. Some of the members bring their processors, and leave them to be used by members who do not have access to a micro. Various languages are in use by members; we have a FORTH interest group in the Club.

Because of conditions at our meeting place there may be changes of venue, but not yet. The hall we meet at is underneath the library and this may be moved downstairs to accommodate the elderly and disabled using the library. By having the library downstairs and the meeting hall upstairs, this will inconvenience fewer using the facilities of the building (it may also improve the facilities available by making room in the building for more spare time activity groups to have a meeting place).

Yours faithfully,
J Turner, PRO
East London Amateur
Computer Club

Dear Sir,

I have just read the article on PROLOG in your February 1982 issue. The description of the language was good, given the available space, but there are background points which were omitted and might be of interest to your readers.

To help put the importance of the language into perspective, there are two points to be made. Firstly, that PROLOG (or a PROLOG-like language) is to be used as the basic systems programming language for the proposed Fifth Generation Japanese computers. Secondly, that one of the most important application areas of PROLOG is in writing 'expert systems' — systems which embody specific areas of human expertise and can be used as consultants in those areas. Expert systems is itself a very important growth area in computing.

For those who wish to find out more, an excellent textbook is now published by Springer-Verlag. Called 'Programming in PROLOG', it describes the facilities and workings of the language for programmers and non-programmers alike. The book was written by Bill Clocksin and Chris Mellish who have themselves

implemented PROLOG. In cases of difficulty, we can supply the book from stock (£8.75 plus £1.15 p&p).

For anyone who is tempted to buy PROLOG, we also sell the Clocksin & Mellish implementation.

Yours faithfully,
Ann Goodall
Knowledge Engineers &
Designers of Expert
Systems
34 Alexandra Road
Oxford OX2 0DB

Dear Sir,

I note that in the process of preparing my contribution to Viewpoint, p17 CT April, 1982, someone has altered one of the sentences in it in such a fashion as to totally destroy the meaning intended. I refer to lines seven and eight of the paragraph headed **An Easy Answer?**

The version printed reads, 'Why this has not been done before I really do not know.' The implication being that I think such courses are a good idea. The text submitted read, 'Why I really do not know.' My intention was to convey that such courses are a waste of time and that the organisers have given little real thought to the problem.

I would be obliged if you would take steps to correct the quite wrong impression which the text, as published, gives.

Yours sincerely,
Les May
Rochdale

(*Apologies in profusion but this was a case of trying to turn the sentence in question into readable English and misunderstanding it ourselves rather than a deliberate attempt to alter your intent. As a general note to authors: if you are seeking to make a point to the reader, do try to put it into clear English before you send it to us...! Ed*)

Dear Sir,

Could you please inform your readers that the North Wiltshire Computer Club is now running and is looking for more members. Meetings are held at Holt village hall on the second and fourth Wednesdays of each month (Holt is between Melksham and Bradford-on-Avon). Anyone is

welcome, from absolute beginners to 'experts', upon paying a 50p entrance fee. Persons who feel they could give us a demonstration talk are welcome to do so.

If you are interested in coming along then either turn up (7.00-11.00), write to Matthew Jones, Pinhills, Bowood, Calne, Wilts SN11 0LY or Gary Hawkins, 198 The Common, Holt, Trowbridge or 'phone Gary on North Trowbridge 782025.

Yours faithfully,
Matthew Jones
Joint Chairman

Dear Sir,

I refer to the article on PROLOG in the February 1982 issue of Computing Today, Pages 42-44. I found this an interesting article, but should like to point out a discrepancy between Figures 1 and 2.

In Figure 1, the family tree, the parents of Bertha are shown as Florence and Walter, and the parents of John as Liza and Dick. In Figure 2, the initialisation of the program, however, the following lines appear.

01300 father (John, Walter)
01400 mother (John, Florence)

02100 father (Bertha, Dick)
02200 mother (Bertha, Liza)
These lines should have read:
01300 father (Bertha, Walter)
01400 mother (Bertha, Florence)

02100 father (John, Dick)
02200 mother (John, Liza)
in order to make the two figures agree. I feel that this could have caused some confusion, as it did with some of my colleagues.

Could you please point this out in the next issue.

Yours faithfully,
J B Owen
Advanced Avionic Systems
Group
British Aerospace
Warton

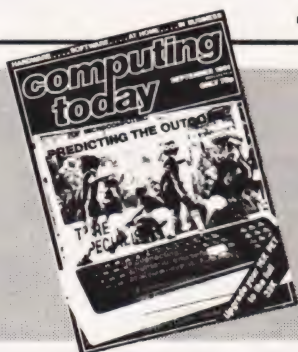
(*While your observations are absolutely correct I think it only fair to point out that these were meant as examples and not as actual working models! However, point taken and my apologies. Ed.*)

BACKNUMBERS



JULY 1981

Holocaust wargame, Data entry validation routines, Multiple column records program, Media survey.



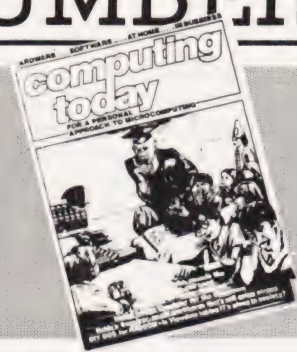
SEPTEMBER 1981

Football pools prediction Pt. 1, Connecting a printer to your micro, VIC reviewed, Upgrading PETs to 32K, Gladiator simulation program.



NOVEMBER 1981

Adler's Alphatronic examined, Teletext explained, Speech synthesis board reviewed, New beginners' guide to BASIC.



DECEMBER 1981

Micros in the classroom, Exidy's Sorcerer revisited, DIY DOS for NASCOM, Making sense out of Reverse Polish, Viewdata explained.



JANUARY 1982

Superbrain revisited, PC 1211 programming, Programming in the FORTH language, Tandy and Sinclair printers reviewed.



FEBRUARY 1982

The Computer Programme investigated, Graphics for Apple, Sorcerer and Tandy, User programmable graphics for ATOM.



MARCH 1982

User report on BBC Micro, DIY computerised security system, Terminology translated, Classroom computers reviewed.



APRIL 1982

The Valley program, TI 99/4 and Tandy Color Computer reviewed, Report on Centronics 737/739 printers, Interfacing series.

Last month's issue is still available as well but has not yet reached the end of its 'shelflife' and is not included for this reason.

If you are thinking of trying to plug some of the holes in your collection of Computing Todays then some fast action is required. Stocks of past issues are running extremely low, we only have the issues shown remaining in stock. If you are missing one of these then now is the time to order it because the

chances are that it won't be in the list next month. All backnumbers cost £1.25 each.

To order backnumbers, simply fill in the form on the page opposite, cut it out and send it to the address given making sure your letter bears the important words **Computing Today Backnumbers**.

PHOTOCOPIES

For those of you who want copies of articles that are located in issues not available as backnumbers we do offer a photocopying service. Each copy costs £1.25 and information as to its title and publication date

NAME

ADDRESS

..... POST CODE

Please send me Photocopies of the following items

| ISSUE | ARTICLE | PAGES |
|-------|---------|-------|
| | | |
| | | |

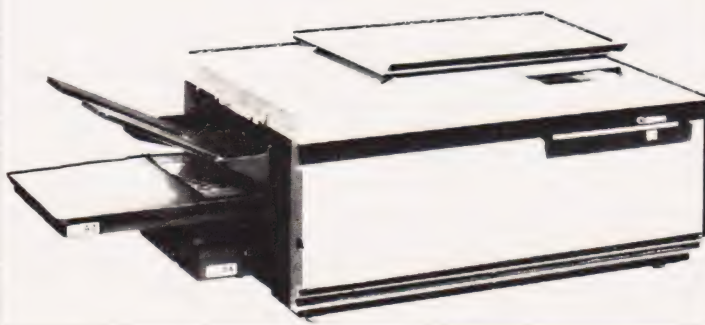
AT £1.25 each I enclose £

Cheques and Postal Orders should be made payable to ASP Ltd

82/4

should be given. Ordering photocopies could hardly be easier, just fill in the coupon, cut it out and send it to the following address:

Computing Today (Photocopies)
145, Charing Cross Road,
London WC2H 0EE



BINDERS

Don't get in a bind with your old copies of CT...
get them in a CT binder



Join the great conservation movement and protect your copies of Computing Today with one of our smart red and black binders. Unlike our competitors you can still squeeze a full year's worth of the magazine into each one and it'll only cost you £4.25.

They look good on any bookshelf and, by keeping all your issues in one place, create a valuable reference library of programs and information.

To order a binder, just fill in the form at the foot of the page, snip it out and send it to us addressed to **Computing Today Binders**.



To order just send your cheque or Postal Order (made payable to ASP Ltd) to:

COMPUTING TODAY
Binders/Backnumbers,
513 London Road,
Thornton Heath,
Surrey CR4 6AR.

NAME

ADDRESS

.....

..... POSTCODE

If you wish to pay by Access or Barclaycard just fill in your card number and sign the form, do not send your card.

BACK NUMBERS

Please send me the following Back Numbers

ISSUE

| |
|--|
| |
| |
| |

AT £1.25 each I enclose £.....
Cheques and Postal Orders should be made payable to ASP Ltd

BINDERS

Please send mebinders @ £4.25 each.

I enclose a cheque/PO for £.....(Payable to ASP Ltd)
I wish to pay by credit card Access Barclaycard

| | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

Insert Card No.

Signature

Please allow 21 days for delivery.



**Ctech Software
Simply Megabytes
Ahead!**

AT  M

DEFENDER: You defend the planet against UFO's, fast moving, Hires Graphics, Sound effects, Thrust, Laser Torpedo, climb, descend, superbly detailed **G4 + T5, £4.00**

ASTRO BATTLEZONE: fastened in the cockpit of your starcruiser, you view the 3D graphics of the earth revolving silently below, staring down your head up display you suddenly glimpse the enemy hurtling towards you, you turn at them, the horizon rolls over, the engines roar as you climb to the stars **G4 + T5 £5.00**

FRUIT MACHINE: Our version has HiResgraphics, nudge, collect, respin, gamble and even plays "Oranges and Lemons" when you win **G3 + T5 £4.00**

POLECAT: Countryside Packman, you must move your Rabbit through the underground maze, but you are being chased by a polecat so you must run like a rabbit until you've collected all your your carrots growing on the top of the Burrow. **G4 + T5 £5.00**

MINEFIELD: You must steer your way through a perilous minefield without exploding any mines; blasting mines can cause chain reactions. **G0 + T5 £5.00**

EARLY WARNING: Atomic Missile Command, destroy the attacking ICBMs using a realistic radar screen and intercept missiles. **G4 + T5 £5.00**

N.B. G = GRAPHICS T = TEXT


ANY 3 ONLY £9.00

**Control Technology, 39 Gloucester Rd,
Gee Cross, Hyde, Cheshire SK14 5JG.**

*All prices include VAT, P&P.
For other Products, see our advert on page 00*



**Full Colour
and
Superb Sound**

VIC-2 
SOFTWARE

*Our latest VIC 20 package is **VICSOFT 7**
and includes all of —*

BREAKOUT: The noisiest and most colourful you've ever seen.

SQUASH: Will you make a tournament champion?

DEATHRACE 2000: Driving in a crazy road race you must run-over as many pedestrians as you can!!

SOUNDS: A sound effects synthesizer program. Everything from helicopters to birds of paradise — menu driven.

MOROIDS: Your astronaut must avoid the asteroids, very fast graphics!!

MASTERMIND: See if you can beat a microelectronic mind at this full colour brain teaser!

WARLORDS: Protect your castle from giant boulders!!

**VICSOFT 7 costs just £5.95 and
that's inclusive.**

MICHAEL ORWIN'S ZX81 CASSETTES

CASSETTE ONE for 1k ZX81

"I had your Invaders/React cassette . . . I was delighted with this first cassette."

P. Rubython, London NW10

"I have been intending to write to you for some days to say how much I enjoy the games on 'Cassette One' which you supplied me with earlier this month. Please let . . . into the secret of your first time load every time!"

E.H., London SW4

Cassette One 1k machine code programs: React, Invaders, Phantom aliens, Maze of death Planet lander, Bouncing letters, Bug Splat.

1k Basic programs:

I Ching, Mastermind, Robots, Basic Hangman PLUS Large screen versions of Invaders and Maze of Death, ready for when you get 16k. Cassette One costs £3.80

CASSETTE TWO

Ten games in Basic for 16k ZX81

Cassette Two contains Othello, Awari, Laser Bases, Word mastermind, Rectangles, Crash, Roulette, Pontoon, Penny Shoot and Gun Command.

Cassette Two costs £5.

CASSETTE THREE

8 programs for 16k ZX81



STARSHIP TROJAN

Repair your Starship before disaster strikes. Hazards include asphyxiation, radiation, escaped biological specimens and plunging into a Supernova.

STARTREK This version of the well known Space adventure game features variable Klingon mobility, and graphic photon torpedo tracking.

PRINCESS OF KRAAL An adventure game.

BATTLE Strategy game, for 1 to 4 players.

KALABRIASZ World's silliest card game, full of pointless complicated rules.

CUBE Rubik Cube simulator, with 'Backstep' facility.

SECRET MESSAGES If you are spying for the KGB, why not throw away those incriminating code books, and buy this innocent looking cassette? This message coding program is txlp qezi jf.

MARTIAN CRICKET A simple but addictive game (totally unlike Earth cricket) in machine code. The speed is variable, and it can run very fast.

Cassette Three costs £5.

Recorded on quality cassettes, sent by first class post, from:

Michael Orwin, 26 Brownlow Rd., Willesden, London NW10 9QL (mail order only please)

Some of this software is also available from: K.J. Software, 8 Cawrse St., Elizabeth Field, South Australia 5113, and Electronic and Commercial Services, Ermou & 8 Fokionos, Athens, Greece.

Your micro is just as adept at handling text as it is at processing numbers — inside the machine they all look the same! This month our series on elementary BASIC programming takes a look at string functions and their uses.

Sadly, we are nearing the end of this series of First Bytes and I have to select what areas of programming to cover in the last two articles. One topic which can cause some initial difficulty is string handling. What is a string? Other than being a length of thin cord, the term is used in the language of computers to represent a set of characters enclosed between quotation marks. These are assigned to a string variable so:-

```
10 A$ = "JOHN SMITH"
```

String variables are identified in most BASIC languages by having the '\$' sign as their last element, a notable exception to this being the Acorn ATOM. Characters enclosed by quotation marks following a PRINT statement are often referred to as 'strings' but are correctly known as 'literals' or 'literal strings'.

Stringing It Together

A string may contain any characters your keyboard is capable of producing *except* quotation marks, these are used to identify the beginning and end of a string and may not be used within a string. Some computers have special 'quotation marks' that may be used within strings, so if your machine has more than one set of quotes make sure you use the right set at the right time!

The computer, however complex it may appear, is at heart a very simple fellow recognising only numbers and even then, only numbers containing one or two different types of digit. From this simple beginning it has to understand and manipulate the programs we write. Each key we press is reduced to a code in the form 1011000. The 1s are represented by an electrical signal and the 0s are represented by the lack of signal; this makes the binary code (as it is known) one of the simplest ways of storing or recognising a coded signal as each element only has two states... either on or off. Each position from the right-hand side represents an increasing power of two; the extreme right-hand position is two raised to the power of zero, so:

```
0000001 = 1 = 20
0000010 = 2 = 21
0000100 = 4 = 22
0000110 = 6 = 22 + 21
1000100 = 64 = 26 + 22
```

ASCII It

What has this to do with strings? Well, every keyboard character has its own code and is stored and manipulated as this number. Most computers use the same code numbers for letters, numerals and certain control instructions (Return for example). This code is known as the ASCII code which stands for American Standard Code for Information Interchange...no wonder we shorten this to ASCII! The ASCII code for A is 65 (1000001), B is 66 (1000010) through to Z at 90 (1011010). Numerals go from zero at 48 to nine which is 57. One very popular computer, the ZX81, uses its own code where zero is 28, nine is 37, A is 38 and Z is 63. To see what code your computer uses you can use the following routine:

```
10 INPUT A$
20 PRINT "ASCII CODE ";A$;" = ";
   ASC(A$)
30 GOTO 10
```

ASC (A\$) returns the ASCII code of A\$. For the ZX81 you would have to use CODE A\$ to return the Sinclair CODE number.

To find what code number is represented by a given code number, use the following routine:

```
10 INPUT A
20 PRINT A;" IS THE CODE FOR ";
   CHR$(A)
30 GOTO 10
```

(Sinclair users omit the brackets in line 20)

You may get a few surprises with this one as some code numbers represent the control keys as 'clear home' and 'cursor control'!

Stringing Along

It is when we are looking at strings and how computers deal with them that we see the greatest disparity in the different dialects of BASIC. PET, Sharp, Apple and Tandy are similar (but not the same!) whereas the Sinclair ZX81 and Acorn ATOM are quite different.

Hopefully, the following will encourage you to get a little more 'hands on' experience at your keyboard. So if your particular BASIC is not covered here, open up that manual and do something with a few strings. Perhaps you can do more with your computer than you could with that cat's cradle of childhood memories!

What can you do with strings? Probably the best approach is to go through the various commands which refer to strings.

1) You can find the number of characters in a string (including spaces) by using the LEN command. Many applications for this will arise by two simple uses which are:

a) to limit an INPUT string so that when PRINTed this string will not continue to the next line thus spoiling an otherwise immaculate display (!) and

b) some computers will only allow a DATA file name of a given maximum number of characters. In this case, we can use the following:

```
10 INPUT A$
20 IF LEN(A$) > N THEN PRINT "NAME
   TOO LONG":GOTO 10
```

N in line 20 is your specified maximum number of characters and if exceeded, a further INPUT is requested.

2) You can perform comparisons between strings, for example:

```
10 INPUT "DO YOU WANT INSTRUCTIONS
   (Y/N)"; A$
20 IF A$ = "Y" THEN 1000
30 IF A$ = "N" THEN 2000
40 PRINT "I SAID...";:GOTO 10
```

Nearly all BASICs will accept comparisons using the equals sign (=) and most will permit the use of <> (not equal to) so the lines 20-40 above could be re-written:

```
20 IF A$ <> "Y" AND A$ <> "N" THEN 10
30 IF A$ <> "Y" THEN 2000
40 GOTO 1000
```

Sharp's BASIC SP 5205 does not allow the use of <> when comparing strings. One way round this would be:

```
30 IF ASC(A$) <> 89 THEN 2000
```

The ASCII code for Y being 89.

Again, some BASICs will permit the use of < (less than) and >

(greater than). Try the following:

```
10 INPUT A$,B$
20 IF A$ > B$ THEN 50
30 PRINT A$;" IS LESS THAN ";B$
40 END
50 PRINT A$;" IS GREATER THAN ";B$
```

What is happening here? You will find that 'CAT' is greater than 'APE' and that 'BALL' is less than 'BAT'. The comparison is applied to the ASCII code (on CODE value) of the first character within each string and if they are the same, the next character in each string is compared. This continues until a difference is found.

3) You may add strings together (but not subtract); this is known as concatenation — which means to 'link up'.

```
10 A$ = "BULL"
20 B$ = "FROG"
30 PRINT A$ + B$
```

If you RUN the above program you will see 'BULLFROG' displayed. Note that there is no space between the strings. If, for example, you had requested INPUTs for a Christian name and a surname you might not want them to run together, so you would have to include an extra space somewhere:

```
30 PRINT A$ + " " + B$
```

If your BASIC has a limit on how many strings may be concatenated, you may have to add strings in stages:

```
30 A$ = A$ + " "
40 PRINT A$ + B$
```

4) You may cut/slice portions from a string using LEFT\$, MID\$ or RIGHT\$. The results of these operations are known as substrings. For example, if A\$="ABCDEFGH", then:

```
PRINT LEFT$(A$,4) gives ABCD
(the left four characters).
PRINT MID$(A$,3,2) gives CD
(two characters starting with the third).
PRINT RIGHT$(A$,3) gives EFG
(the right three characters).
```

Do check your manual first for how the BASIC on your own machine handles strings. Although I have yet to come across them, I believe some BASICs number the left-hand character as zero and not as in the above examples!

Slicing Through

The ZX81 uses a different system altogether. I'm told it is old-fashioned but I find it easy to use and, in some ways, more versatile. It is referred to as slicing and takes the

form: string expression (start TO finish).

So, if A\$="ABCDEFGH", then:

```
PRINT A$(2 TO 5)
gives
BCDE
(second to fifth characters inclusive).
```

If you omit the start point (2 in the example above) the default condition assumes a 1:

```
PRINT A$(TO 5)
gives
ABCDE
(first to fifth characters).
```

If you then omit the finishing point, the default condition assumes the length of the string:

```
PRINT A$(3 TO)
gives
CDEFG
(third to end of string).
```

However, if only one number is in the brackets and there is no TO, then:

```
PRINT A$(3)
gives
C
(third character only).
```

On the ZX81, you may also assign a string to any position within another string:

```
10 LET A$ = "ABCDEFGH"
20 LET A$(2 TO 7) = "LL PUS"
30 PRINT A$
```

This routine will give you 'ALL PUSH' — that surely must give the budding cryptographer some interesting possibilities!

One example using several of the above commands is:

```
10 PRINT "WHAT IS YOUR NAME"
20 INPUT "TYPE SURNAME LAST";A$
30 FOR I = 1 TO LEN(A$)
40 IF MID$(A$,I,1) = " " THEN 60
50 B$ = LEFT$(A$,I)
60 NEXT I
70 PRINT B$
80 END
```

Should you type in your name as 'JOHN DOE', the program will scan the character INPUT until it finds the space between JOHN and DOE (line 40). At the point the computer finds the space, the first name will have already been assigned to B\$ (line 50) on the last pass through the IF...NEXT loop.

5) BASIC does not allow a number to be assigned to a string — so, A\$=1234 will not be accepted.

Should you wish to do this, you must either:

a) enter it as an INPUT

```
10 INPUT A$
```

b) or, if a number (x) has been generated within a program, it may be assigned to a string variable using STR\$:

```
70 A$ = STR$(X)
```

6) If you wish to reverse the process and extract a number from a string you will have to use VAL. This will return a zero if there are only non-numeric characters within a string and a numeric value if only numbers are present.

VAL("ABCD") gives zero
VAL("1234") gives 1234
VAL("12AB") can give either zero or 12 depending upon which BASIC you are using! Obviously it is important to check which results your machine returns...

Having extracted your numeric value using VAL, all the normal arithmetic operations may now be performed.

Next month we will take an elementary look at arrays and if we have time, discuss some of the points raised in the letters I receive from you.



PROGRAM POWER PROGRAM POWER

ATTENTION ALL ACORN

ATOM

OWNERS!

Look
Special Low
Prices

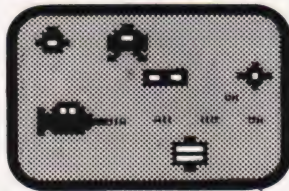
QUALITY PROGRAMS FROM BRITAIN'S LEADING ATOM SOFTWARE HOUSE



CHES (12K)
Improved graphics, plays black or white, mid game level changes, look ahead up to 8 moves, offensive, normal & defensive play, 10 sub levels, casting, 'En passant' by player. Rejects illegal moves. Take back moves & action replay with take over. Set up problem games. **£7.95**



AIR ATTACK
Command an East Coast anti-aircraft battery. Destroy enemy fighters, bombers and doodle-bugs. Ingenious graphics depict planes approaching, veering and flying off. Search the sky and scan the landscape through 360 degs. **GOOD SOUND. GREAT ENTERTAINMENT £7.95**



SPACE FIGHTER (6K + 3Kgr)
Super High speed 'Defender' game. 5 types of intelligent aliens. Repeating laser cannon, smart bombs, hi-score, rankings, bonus points, 6 skill levels. Exciting sound effects. **£7.95**



COWBOY SHOOT-OUT (12K)
Full feature, two player, arcade shooting game. Cactus plants, wagons, animated cowboys. Superb graphics and sound **£6.95**

Adventure

ALL THE EXCITEMENT, INTRIGUE AND FRUSTRATION OF A MAIN-FRAME ADVENTURE! 12K
Explore the tortuous forests, dark caverns & castle dungeons. Beware the maze of twisting tunnels and the desert wastelands. Outwit the predators. Rescue the PRINCESS and carry off the treasures.
Great skill & imagination are required to play this excellent game & you may still never exhaust all the possibilities.
By devising methods of condensing messages, the author has been able to include many features which would otherwise be available only on much larger computers. Start your adventure now - **£7.95**

PROGRAMMER'S TOOLBOX

(PACKED 4K EPROM) **£24.50**
★ 1200 BAUD CASSETTE OPERATING SYSTEM
★ VISIBLE LOAD & SAVE

| | | | |
|------------------|----------|---------------|--------|
| ● TRACE (X) | READ | ON ERROR | HEX |
| ● LTRACE | DATA | RENUMBER X, Y | IHEX |
| ● STEP | RESTORE | AUTO X, Y | OFF |
| ● FIND | ELSE | CURSOR X, Y | VECTOR |
| VAR | WHILE | BEEP X, Y | ZERO |
| LVAR | ENDWHILE | KEY X | POP |
| DELETE X, Y DUMP | INKEY X | STOP | |

(● VIA chip required)
Suitable for any memory size
Greatly enhances ATOM existing facilities.

Now available from many Atom Dealers.

1000
ATOM USERS
CAN'T BE
WRONG!

ALSO FEATURED IN OUR EXTENSIVE RANGE ARE -

- WARLORDS (12K)** Another High-speed arcade game with the medieval touch. Defend your castle and destroy your opponents. Play against computer or other player. Exciting graphics **£6.95**
- MUNCHYMAN (6K)** Outrun the munchers (or puckmen). Eat your way to a high point score and confrontation with the SUPERMUNCHERS **£4.95**
- 3D ASTEROIDS (6K + 2Kgr)** Steer through the rolling, hurtling asteroids. Excellent real life graphics **£5.95**
- MARTIANS (12K + VIA)** Use your force field to stop them landing. Beware the imposters **£6.95**
- LUNAR LANDER (12K)** Superb version of this arcade game, including long and short range scans, limited fuel supply **£6.95**

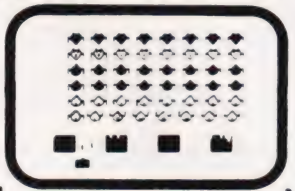
ROM SELECTOR BOARD

Suffering from congestion? (PROGRAMMER'S TOOLBOX, WORD PROCESSOR etc.) Switch between up to 4 ROMS located at Hex A000. Assembled and tested unit with compact, professionally produced PCB and good quality components. Fits easily into the Utility Socket (IC 24). **Only £19.50**

★ **WRITTEN ANY PROGRAMS!** ★
★ **WE PAY 20% ROYALTIES FOR ATOM, NASCOM & BBC MICRO PROGRAMS** ★



ASTROBIRDS (12K)
NEW version of this incredible GALAXIAN type game. Fantastic sound effects. Screaming missiles & swooping bird men. NOW DOUBLE SPEED OPTION. The best game on the market **£7.95**



INVADER FORCE (12K)
Terrific version of Space Invader. 4 types of invaders, mother ship, great sound, hi-score, 6 skill levels. **£7.95**

SPECIAL OFFER Deduct **£1** per cassette when ordering two or more.

Please add 55p order P & P + VAT at 15%

Send SAE for our Full Catalogue

PROGRAM POWER

PROGRAM POWER
5 Wensley Road
Leeds LS7 2LX
Tel. (0532) 683186



SINCLAIR COMPUTERS

We are the leading world-wide Sinclair export specialist including Norway, Sweden, Finland and Denmark. Write for our surprisingly low prices.

PRINTERS

Buy any of the below and get a free interface kit and word processor program for UK101 or Superboard. Seikosha GP80A £205. Centronics 737 £335. Centronics 739 £419. OKI Microline 80 £275. OKI Microline 82A £399. Epson MX70T £259. Epson MX80T £339. Epson MX80F/T1 £375. Epson MX80F/T2 £375. Epson MX100 £495.



Buy any of the below and get a free interface kit and word processor program for UK101 or Superboard. Seikosha GP8100A £205. Centronics 737 £335. Centronics 739 £419. OKI Microline 80 £275. OKI Microline 82A £399. Epson MX70T £259. Epson MX80T £339. Epson MX80F/T1 £375. Epson MX80F/T2 £375. Epson MX100 £495.



SWANLEY ELECTRONICS
Dept CT, 32 Goldsel Rd,
Swanley, Kent BR8 8EZ,
Tel Swanley (0322) 64851

UK101 AND SUPERBOARD

UK101 32x48 display expansion kit £9. The below accessories suit both the UK101 and Superboard:- Extra ram £2.10 per K. 16K memory expansion complete kit £50, built £58. 32K memory expansion kit £74, built £82. Cegmon £22.50. Wemon £14.95. Word processor program £10. Centronics interface kit £10. 610 expansion board £179. Cased minifloppy disc drive with DOS £275. The below suit only Superboard:- Guard band kit £10. Series 1 only 30x50 display expansion kit £14.

NEW GENIE 1 £299

EG3014 Expansion box with 16K/32K ram £199/£213. We are Cumana disc drive specialists for the Genie. Single sided disc drives:- 40 track £205, dual 40 track £345, 80 track £269, dual 80 track £469. Double sided disc drives:- 80 track £399, dual 80 track £699. Double density convertor £72. Parallel printer interface £36.



5V POWER KITS

Fully stabilized 5V computer and TTL power kits. Short circuit and over-voltage protection. 1.5A £7.83, 3A £12.17. 6A £20.

SHARP COMPUTERS

MZ80K 48K £335. 46 sample programs for £15. We can supply any Epson MX80 printer to run direct from the MZ80K (I/O box not needed) for £39 plus printer price. We also specialize in interfacing printers to the MZ80K, MZ80A and MZ80B both with and without the I/O box.

Postage £3.50 on computers, £4.50 on printers and 50p on other orders. Lists 27p post free. Please add VAT to all prices. Official credit and overseas orders welcome.

PUT YOUR MICRO TO WORK!



YOUR MACHINE

CONTROL MACHINES, ROBOTS, FACTORY OR HOME

Have you ever wanted your MICRO to control a machine for you, or manage your house? If so, the MDR 'MICROCOMPUTER CONTROL INTERFACE' will give you isolated channels of OUTPUT (8A @ 250 volts) and switch sensing INPUTS.

Available now for connection to PET USER, PORT, RS232 and IEEE488, allowing expansion up to more than 900 channels.

Supplied complete with connecting cables, full data and guarantee from £12.54 per channel. Complete preprogrammed systems or individual components available. Write or phone for details.

M D R (INTERFACES) LTD.
Little Bridge House, Dane Hill,
Nr. Haywards Heath, Sussex RH17 7JD.
Telephone: 0825-790294.

ATTENTION

NASCOM USERS

ATTENTION

Ikon Computer Products pioneers in product development have broken the £100 barrier in data storage systems.

The HOBBIT CASSETTE system is available at only £99 plus VAT. This ready built, but unboxed, data storage system is based on a Phillips Mini Cassette with drive unit, interface board, firmware (in 2 2708's), manual, cassette with 100K storage, transfer speed of 750 bytes/sec. The Hobbit is compatible with all Nascom Computers and Monitors.

£99

IKON — Sophistication at a realistic price

£99

£113.85 (incl. VAT) for the Hobbit Unit available from:

IKON Computer Products
Kiln Lake
Laugharne
Carmarthen
DYFED
Tel: (099 421) 515

NASCOM 1&2

THE NEW SPACE ERA

MOON RAIDER (MC/G)—'Scramble' type game with superb SOUND effects through Keyboard Port. Raid enemy dumps, blast asteroids & defending ram-ships. Limited fuel. 4 skill levels. £8.95

STARSHIP COMMAND (16K/B/G)—3D galaxy (9x9x9). 6 levels from Commodore to Space Marshall. Excellent combination of galactic search and M/C code battles. £9.95

JAILBREAK IN SPACE (16K/MC/G)—Fast arcade game. Beat off the alien rescue ships attacking your jail. Hold onto your high security prisoners as long as possible. £8.95

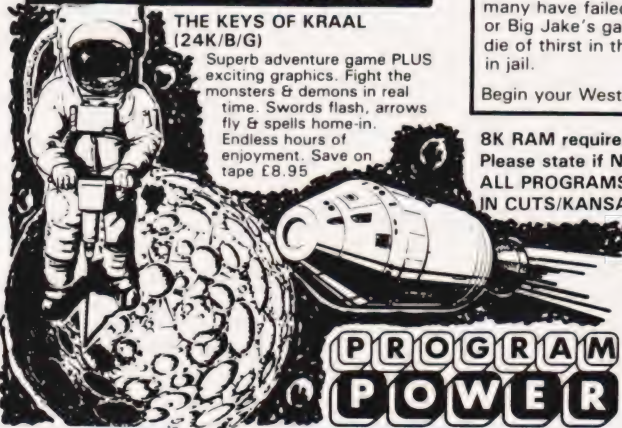
NEW FASE (16K/MC/G)—Action packed invaders prog. 4 different enemy fleets, individual motion, direct & 'truly' angled missiles. £7.95

SPECIAL OFFER

Deduct £1 per cassette when ordering two or more.

THE KEYS OF KRAAL (24K/B/G)

Superb adventure game PLUS exciting graphics. Fight the monsters & demons in real time. Swords flash, arrows fly & spells home-in. Endless hours of enjoyment. Save on tape £8.95



A GREAT NEW ADVENTURE

ELDORADO GOLD

Welcome to a past age, when cowboys ruled the roost and indians terrorised the new settlers. In ELDORADO COUNTY many fortunes were made—and nearly as many lost! Legend has it that Old Bill McCluskey, who met a rather sudden death, had built up a vast treasure somewhere in the nearby territory. Can you end up a rich man where many have failed? If the marauding Apaches or Big Jake's gang don't get you, you may die of thirst in the desert or starve to death in jail.

Begin your Western Adventure NOW £7.95

8K RAM required unless otherwise stated. Please state if Nascom TAPE Basic required. ALL PROGRAMS SUPPLIED ON CASSETTE IN CUTS/KANSAS CITY FORMAT.



Please add 55p/order P & P + VAT @ 15%.

Large (15 1/2 p) Sae for FULL CATALOGUE. PROGRAM POWER 5 Wensley Road Leeds LS7 2LX Tel. (0532) 683186

NASPRINT 80

2K extension to NASPEN. New functions incl. Pagination, page no. & title output, title centering & text re-formatting with embedded control codes change line length, spacing & margins; centre line between margins; new page; output printer control codes. Contains parallel printer routine for MX80. Use with serial or other parallel catered for. Special routines facilitate operation with ZEAP, NAS-DIS, DEBUG, NAS-SYS & ROM BASIC. In Eproms £14.95

NASCOM 1

Cottis Blandford cassette interface for N2 format, reliability & fast load. £14.90

AY-3-8910 SOUND CHIP

INVASION EARTH with INCREDIBLE SOUND EFFECTS (MC/G) £10.95

SOUND CHIP—Program up to 3 independent channels, with music & sound effects! Data sheet incl. £6.45

SOUND CHIP INTERFACE BOARD—Designed to interface between the PIO & the chip. Ready built—plugs straight onto PIO. Nascom 1 connectors available. Sound generation illustrated in MC. & Basic. (chip not incl.) £13.50

DEMO PROGRAM (MC) 1st mode—direct entry to chip register making experimentation simple, 2nd mode—turns keyboard into 7 octave 'piano', giving state of registers & notes played. £5.95

DATA MANUAL (60 pages) No VAT £2.25

BASIC FILE HANDLER (MC)

for cassette-based systems.

PAYROLL, SALES & PURCHASE LEDGERS, PRICE LISTS etc.—NOW you can write them! Save complex data files on cassette—any combination of strings, string variables, string arrays, constants, expressions, variables or arrays. Definable block size. At 2400 BAUD using 1K blocks, 1000 numbers can be stored/ accessed in less than 1 min. Comprehensive manual & circuit for optional automatic cassette drive control supplied. £17.50

"MICRO-POWER"—Magazine

Series Article on hardware & software, news from clubs, letters, point of views, questions & answers. Now available issues 1-4 £3.95 (Europe £6.60) & overseas (£7.90). 1982 Subscription (six issues £5.95), (Europe £9.80, overseas £11.80).

BBC MICRO

SOFTWARE from PROGRAM POWER

MODEL A or B

CHESS

High quality chess game with castling, 'en passant', play black or white, rejection of illegal moves and 6 levels of play. Set up problem games. £7.95

STARTREK

Full feature version of the classic battle against the Klingons. All the usual features—phasers, photon torpedoes, long and short range scans, 'on-board' computer - together with sound effects and 'real-time' torpedo battles. £7.95

MUNCHYMAN

Colourful and highly entertaining version of this popular arcade game. Munch your way to a high score, before the 'munchers' devour you. Reverse roles by munching the stars. The more you score, the harder the game gets. £5.95

GOMOKU

Well presented board game, written in Basic and m/c code. The objective is to be first to get five counters in a row. The computer plays a tough game and is very hard to beat, especially when making first move. £3.95

DISASSEMBLER

Relocatable program. Lists object code and assembler mnemonics from any specified address. Stop and restart the listing, page mode option, ASCII symbol and printer output options. £5.95

MODEL B ONLY

SPACE MAZE

You have crash landed in the legendary labyrinth of Titan, inhabited by alien monsters known as 'Froogs'. Find your way out to the 'Transmat' probe before being cornered and eaten. 8 skill levels and 3D colour graphics. £5.95

Special Offer

ORDER BEFORE 30th JUNE AND SAVE £££'s

We are giving Fabulous discounts on all our BBC MICRO Programs **IF YOU BUY NOW.**

CHESS (£7.95) now £4.95.

STARTREK (£7.95) now £4.95. MUNCHYMAN, DISASSEMBLER & SPACE MAZE (£5.95): Now £3.95. GOMOKU (£3.95) now £2.95

Please add 55p order P & P + VAT at 15%

PROGRAM POWER
5 Wensley Road
Leeds LS7 2LX
Tel. (0532) 683186

At what point does a package become a language? Well, with GINO-F that distinction has become somewhat blurred. It can now be regarded more as a graphics language than as a FORTRAN program.

GINO-F is a general purpose graphics language. Actually, it is not a formal computer language in the sense that other languages covered in this series are; languages such as BASIC, Pascal and FORTRAN are designed to be completely self-contained, providing all the facilities required by a programmer to describe a computation. By contrast GINO-F provides a set of routines which can be called from a FORTRAN program to generate a particular graphics display.

However, many graphics programs consist of calls to the appropriate GINO-F routines within a minimal FORTRAN framework and to this extent, GINO-F can be regarded as a graphics language (graphics programs are written by combining their routines in much the same way as assembly code programs are written by combining assembly code instructions). Graphic displays can be produced by a number of devices, including high-resolution refresh displays and graph plotters. When a GINO-F program is run, it generates the commands which cause the display device to generate the required image. The analogy with assembly code is that when an assembly code program is run it causes the processor to give the required behaviour when it obeys the successive assembly code instructions.

Picture This

A graphics package called GINO preceded GINO-F; it was developed at Cambridge University and was written in Assembler. The name is derived from the words Graphical Input and Output, which describe the function of the package. The CAD Centre at Cambridge subsequently developed GINO-F, a more systematically designed package, providing for all commonly used graphical activities rather than just for input and output. It is written in FORTRAN, hence the F in its name. As well as being a graphics language, it allows graphical displays to be generated by existing programs when the ap-

propriate GINO-F elements are incorporated.

The package was originally intended for use on mainframe computers but it is currently due for release in a microcomputer version. As the high-resolution displays on microcomputers improve in resolution, and also as good quality graph plotters become readily available for micros, the need for a coherent graphics language such as GINO-F has become more urgent.

At the moment, of course, the graphics facilities available on micros are usually provided by adding extra commands to the BASIC of each micro. This results in the totally different graphics commands possessed by, for example, the Apple, the Acorn ATOM and the Atari. However, it is interesting to observe that the instructions added to these BASICs are quite heavily influenced by the facilities possessed by GINO-F and other similar graphics packages.

Featuring GINO-F

GINO-F is available for a wide range of large computers, providing the portability of graphics programs so completely lacking in microcomputer graphics. There is no standardisation at all in the high-resolution graphics commands and capabilities of microcomputers; when block graphics or character graphics (such as those possessed by the PET) are considered, their usage differs even more widely from one micro to another.

GINO-F also provides programs which are independent of the output device used allowing the output to appear on a high-resolution monochrome display, a colour display or a graph plotter merely by nominating the device to be used at the beginning of the graphics part of the program. Elements which do not apply to the particular device in use, such as colour commands when a monochrome display device is be-

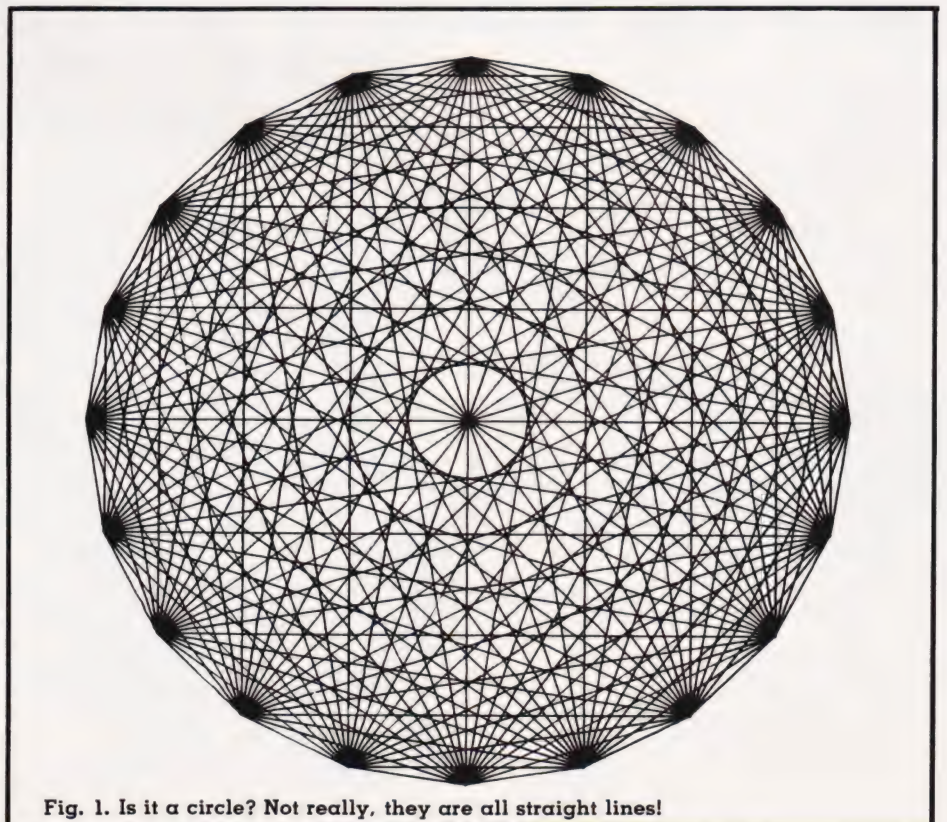


Fig. 1. Is it a circle? Not really, they are all straight lines!

PROGRAMMING LANGUAGES

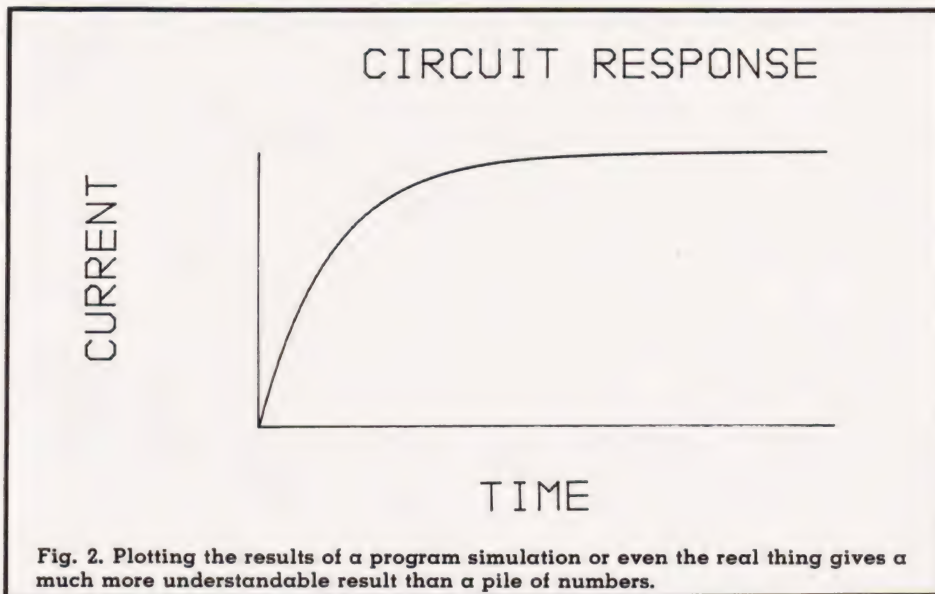


Fig. 2. Plotting the results of a program simulation or even the real thing gives a much more understandable result than a pile of numbers.

ing used, will simply be ignored.

The facilities provided by GINO-F fall into the following categories:

Administrative This group includes the facilities for naming the output device, so that all the commands generated by the graphics program when it is run will be for the output device displaying the picture. It also includes facilities for establishing the size of the picture to be drawn and for ending the graphics part of a program.

Two-dimensional drawing In this group there are facilities for drawing lines and curves and for moving the drawing head to any location without drawing. With these commands any drawing, graph or figure can be produced.

Three-dimensional drawing The facilities for three-dimensional drawing permit any three-dimensional object to be described. The object can be displayed on a (two-dimensional) screen or plotted when the position from which it is to be observed and the projection to be used have been defined.

Transformations Besides the projective transformations for displaying three-dimensional objects, this group includes the transformations of rotation, scaling and shifting for both two- and three-dimensional objects. When a transformation is invoked in a program, it applies to all the drawing commands which follow it. Thus, if the transformation to rotate through 45 degrees is invoked, everything drawn subsequently is rotated through 45 degrees.

Character output With these facilities, characters can be included in a graphic display, for example, to label an axis in a graph. The

size and orientation of the characters can be established independently from the rest of the graph.

Interaction These facilities permit interaction with a program, for example, by means of a light pen.

The following simple program will cause a square to be plotted:

```
CALL HP7220
CALL UNITS(10.0)
CALL MOVTO2(2.0,2.0)
CALL LINTO2(2.0,4.0)
CALL LINTO2(4.0,4.0)
CALL LINTO2(4.0,2.0)
CALL LINTO2(2.0,2.0)
CALL DEVEND
STOP
END
```

Note that the graphics part of the program consists of a sequence of calls to GINO-F subroutines. The names of the subroutines usually more or less explain their function. The first call nominates the HP-7220 graph plotter as the output device (incidentally, the diagrams in this article were all drawn on this plotter). The second call fixes the plotting units. By default, the plotting units are millimetres, but this call makes the plotting unit 10 mm.

The next call moves the pen with the pen up (so that no line is drawn) to the point specified. The origin is taken as the bottom left corner of the plotting area, so this call leaves the pen two centimetres above and two centimetres to the right of this corner. The following four calls each cause lines to be drawn from the current position to the position given in the instruction, thereby causing the four sides of the square to be drawn. The call to DEVEND terminates the graphics part of the program, while the last two lines are required to terminate a FORTRAN

program. The program draws a square with sides of two centimetres long in a precisely determined position. In much the same way, the position and size of all drawings can be precisely determined.

The next program generates the pattern shown in Fig. 1.

```
DIMENSION X(20), Y(20)
CALL HP7220
CALL UNITS(10.0)
CALL SHIFT2(12.0,12.0)
ANGLE=0.0
AINC=6.2831853/20.0
DO 10 I=1,20
  ANGLE=ANGLE+AINC
  X(I)=8.0*COS(ANGLE)
  Y(I)=8.0*SIN(ANGLE)
10 CONTINUE
DO 20 I=1,19
  IPI=I+1
  DO 30 J=IPI,20
    CALL MOVTO2 ( X(I), Y(I) )
    CALL LINTO2 ( X(I), Y(I) )
30 CONTINUE
20 CONTINUE
CALL DEVEND
STOP
END
```

The program computes the locations of 20 points equally spaced around the circumference of a circle and then joins each point to all the others. This is done in a way which avoids drawing each line twice. The way the graphics elements are embedded in a FORTRAN program is clearly shown. The call to SHIFT2 is a transformation which conveniently shifts the drawing into the centre of the plotting area. It effectively moves the origin for the drawing from the corner of the plotting area into the centre.

The simple graph in Fig. 2 was generated by the next program.

```
DIMENSION X(80), Y(80)
DO 10 I=1,80
  X(I)=0.1*(I-1)
  Y(I)=4.0*(1.0-EXP(-X(I)))
10 CONTINUE
CALL HP7220
CALL UNITS(15.0)
CALL SHIFT2(4.0,4.0)
CALL MOVTO2(0.0,4.0)
CALL LINTO2(0.0,0.0)
CALL LINTO2(8.0,0.0)
CALL CURTO2(X,Y,80,0,0)
CALL CHASIZ(0.4,0.4)
CALL MOVTO2(3.0, -2.0)
CALL CHAHOL('TIME .')
CALL MOVTO2(1.5,7.0)
CALL CHAHOL('CIRCUIT RESPONSE*.')
CALL MOVTO2(-2.0,1.0)
CALL CHAANG(90.0)
CALL CHAHOL('CURRENT*..')
CALL DEVEND
STOP
END
```

The call to CURTO2(X,Y,80,0,0) draws a smooth curve through the 80 points with their x and y coordinates respectively in the arrays X and Y. The calls following CURTO all deal with the characters on the graph. CHASIZ gives the characters' size by fixing their width and height. Each line of characters

is positioned using MOVTO2, CHAANG being used to change the angle at which the characters are printed if this is necessary. Finally, the text to be written is given in a call to CHAHOL (the letters to be written are terminated with an asterisk and a full stop).

Any shape which has the x and y co-ordinates of its points stored in arrays X and Y, respectively, can be drawn by a routine such as the following:

```

SUBROUTINE PLANE
DIMENSION X(100), Y(100)
CALL MOVTO2( X(1), Y(1) )
DO 10 I=2,100
CALL LINTO2( X(I), Y(I) )
10 CONTINUE
RETURN
END

```

The next program fragment generated the shape illustrated in Fig. 3. This shows that once a shape is stored it can be drawn in many ways using the various transformations.

```

DO 50 K=1,4
CALL PLANE
CALL SHIFT2(6.0,1.5)
CALL ROTAT2(10.0)
CALL SCALE(0.8)
50 CONTINUE

```

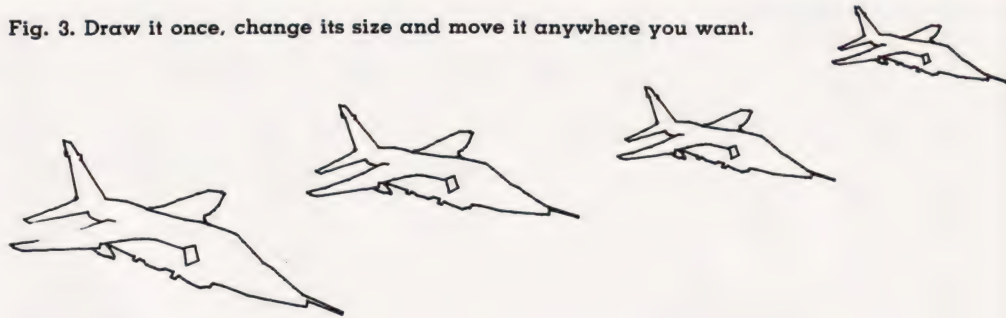
The aeroplane is plotted at its correct size once, but then it is scaled down, rotated and shifted prior to each of the succeeding plots.

3-D Drawing

The realistic display of three-dimensional objects on a two-dimensional surface is made quite easy in GINO-F. A three-dimensional object is described by giving the instructions for 'drawing' it in three dimensions. Before the object is displayed on a screen or plotted, the position from which it is to be viewed and the direction of viewing must be given. Then, calling the transformation routine VIEW automatically causes the appropriate perspective view of the object to be drawn when the three-dimensional drawing commands are executed. Program listing 1 produced the drawings shown in Fig. 4.

The description of the object is embodied in the 24 three-dimensional drawing calls to MOVTO3 and LINTO3. The call to the routine VPOINT establishes the viewpoint and the direction of viewing; using different values for x, y and z in this routine is all that is necessary to generate different views of the object.

Fig. 3. Draw it once, change its size and move it anywhere you want.



On Your Micro

GINO-F is currently due to be released for the Research Machines 380Z. This particular machine supports FORTRAN allowing the graphics package to be made available in essentially the same form as for mainframe machines as a set of FORTRAN subroutines. Thus, at least one micro will support a powerful and coherent graphics language.

The high-resolution displays possessed by micros such as the Apple, the Acorn ATOM and the BBC microcomputer can display complex and detailed images, and they deserve a language making it comparatively easy to produce such images. Of course, they can produce impressively detailed images in-

cluding displays of three-dimensional objects (the manual provided with the ATOM includes a program for generating perspective views of a convoluted surface, the results of which are most impressive) but considerable study is necessary to understand how the program works. All effects are produced from first principles and the perspective transformation is explicitly programmed. If you wish to fully understand the techniques of computer graphics, this is fine, but it makes life very difficult for the user who merely wants to take advantage of the graphics for a particular application.

The widely differing nature of the graphics commands provided by the BASIC languages of various micros can be illustrated quite simply. The programs equivalent to the GINO-F program given above to plot a square are, for the Apple:

```

10 HGR:HCOLOR=3
20 HPLOT 20,20
30 HPLT TO 20,40
40 HPLT TO 40,40
50 HPLT TO 40,20
60 HPLT TO 20,20

```

and for the ATOM:

```

10 CLEAR 4
20 MOVE 20,20
30 DRAW 20,40
40 DRAW 40,40
50 DRAW 40,20
60 DRAW 20,20
70 END

```

Clearly the two BASICS possess broadly equivalent commands but a good deal of translation needs to be done to convert a graphics program from one machine to another. Just as annoying is the fact that neither program generates a square — they produce rectangles whose size and shape depend on the resolution provided by the system. Both PLOT TO X,Y and DRAW X,Y draw a line from the current position to the dot in the screen position in column x and row y.

```

DIMENSION X(4),Y(4),Z(4),U(4),V(4)
CALL HP7220
CALL UNITS(12.0)
DATA X/5.0,0.0,5.0,3.0/
DATA Y/4.0,5.0,0.0,2.0/
DATA Z/3.0,3.0,3.0,3.0/
DATA U/5.0,15.0,5.0,15.0/
DATA V/5.0,5.0,12.0,12.0/
DO 10 I=1,4
D=SQRT( X(I)*X(I)+Y(I)*Y(I)+
Z(I)*Z(I) )
CALL VPOINT(X(I),Y(I),Z(I),-X(I),
-Y(I),-Z(I),D)
CALL VPOSIT(U(I),V(I))
CALL VIEW
CALL MOVTO3(-1.0,-1.0,1.0)
CALL LINTO3(1.0,-1.0,1.0)
CALL LINTO3(1.0,-1.0,-1.0)
CALL LINTO3(-1.0,-1.0,-1.0)
CALL LINTO3(-1.0,-1.0,1.0)
CALL LINTO3(1.0,1.0,-1.0)
CALL LINTO3(-1.0,1.0,-1.0)
CALL LINTO3(-1.0,1.0,1.0)
CALL LINTO3(1.0,1.0,1.0)
CALL LINTO3(1.0,1.0,-1.0)
CALL LINTO3(1.0,2.0,-1.0)
CALL LINTO3(-1.0,2.0,-1.0)
CALL LINTO3(-1.0,2.0,1.0)
CALL LINTO3(1.0,2.0,1.0)
CALL LINTO3(1.0,2.0,-1.0)
CALL MOVTO3(-1.0,2.0,-1.0)
CALL LINTO3(-1.0,1.0,-1.0)
CALL LINTO3(1.0,-1.0,1.0)
CALL MOVTO3(1.0,-1.0,-1.0)
CALL LINTO3(-1.0,1.0,1.0)
CALL LINTO3(-1.0,2.0,1.0)
CALL MOVTO3(1.0,2.0,1.0)
CALL LINTO3(1.0,1.0,1.0)
CALL LINTO3(-1.0,-1.0,-1.0)
CALL TRANSF(2)
10 CONTINUE
CALL DEVEND
STOP
END

```

Listing 1. A GINO-F program to produce the objects shown in Fig. 4.

PROGRAMMING LANGUAGES

A further complication with these two machines is that the screen origin (ie the dot in column 0 and row 0) is the bottom left for the ATOM (as you might expect), but at the top left for the Apple. Consequently, two programs that are apparently equivalent give rectangles not only different in size and shape but also occupying different positions on the screen. (It should perhaps be mentioned in passing that there are alternative ways to write these programs using different graphics commands for both the Apple and the ATOM.)

The problems of a language designer wondering which graphics commands to add to the BASIC of a particular micro could be resolved by turning to GINO. Although GINO-F is written in FORTRAN, there is no reason why an equivalent version could not be written in BASIC; such a version would be ideal for micros, providing a general-purpose graphics language which could be added to any BASIC as required. This would make it far easier to tap the potential power of the graphics on any micro with high-resolution facilities.

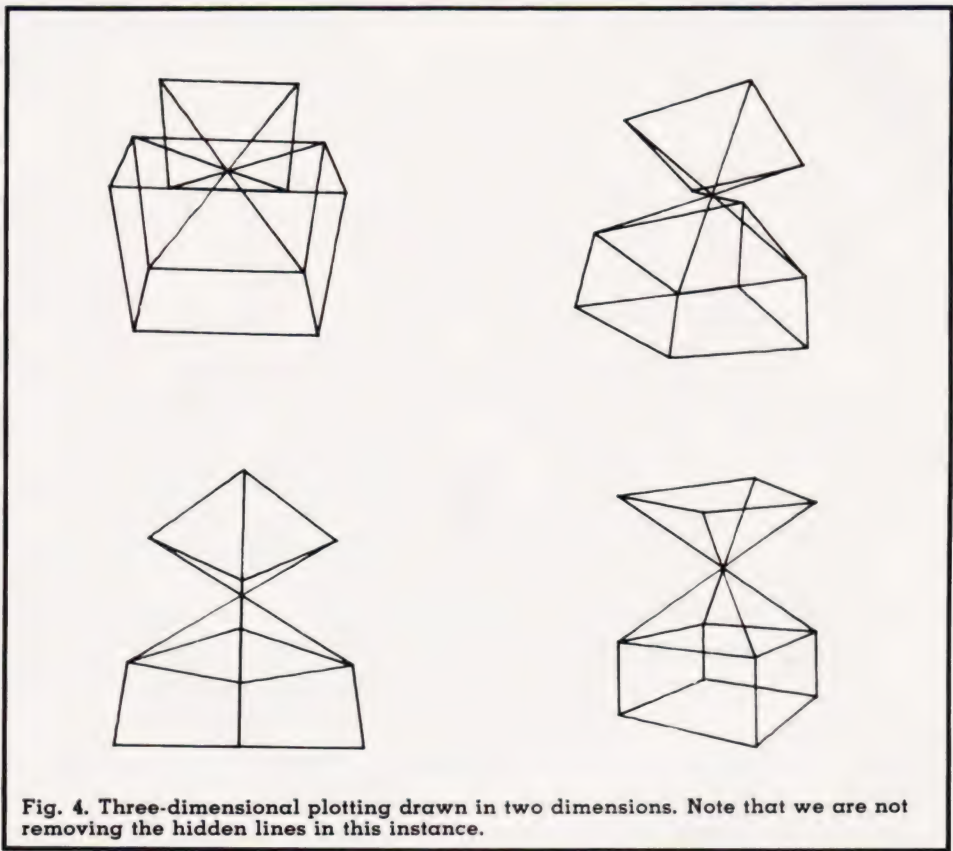


Fig. 4. Three-dimensional plotting drawn in two dimensions. Note that we are not removing the hidden lines in this instance.

32K MEMORY EXPANSION

CARTRIDGE for VIC-20

- * Fully Built *
- * Cased *
- * No PSU Required *

All the memory you will ever need !

32K Cartridge £79.00

16K Cartridge £49.00

(Expandable to 32K)

6116 ICs £5.90

Please Include £1.00 p/p & VAT at 15%

We also supply:-

- * ACORN ATOM Cassettes.
- * BBC MICRO Discs.
- * NASCOM Printers.
- * GEMINI Components.

NEWBURN ELECTRONICS

Manse Road,
Ballycarry,
Carrickfergus,
Co. Antrim.
(Whitehead 78330).

Run **BBC** type BASIC on your ATOM

then switch back to ATOM BASIC

Available now from Acornsoft, a 20k BBC ROM conversion module which can be added inside an Atom. It will support the full set of BBC - type BASIC commands. The BASIC syntax is identical so all programs that don't rely on the BBC hardware can be run on the Atom without any modification.

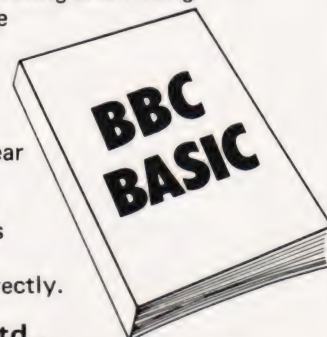
The module is fitted in parallel with Atom BASIC and may be selected by a switch or from the keyboard if certain modifications are made. It consists of 16k BASIC ROM, 4k operating system ROM and an additional 2k RAM that can be used by the Atom as well.

Complete with manual

A comprehensive BBC - type BASIC manual is supplied with every set giving full operating and fitting instructions, alternatively the module can be fitted by your dealer.

The price is £49.95 including VAT.

If you don't have a dealer near you just write to us with a cheque at the address below, or credit card holders holders can ring Cambridge (0223) 316039 and order directly.



Dept CT, Acornsoft Ltd.,
4a Market Hill, CAMBRIDGE CB2 3NJ

ACORNSOFT

**BBC VERSION
NOW AVAILABLE**

THE VALLEY



© Computing Today 1982

What are you . . . Barbarian or Wizard?

Choose your character type carefully . . . Barbarians recover quickly but their magic doesn't come easily. A Wizard? Slow on the draw and slow to mature . . . but live long enough and grow wise enough and your lightning bolts are almost unstoppable . . .

The Valley is a real-time game of adventure and survival. You may choose one of five character types to be your personal 'extension of self' to battle and pit your wits against a number of monsters. Find treasure, fight a Thunder-Lizard in the arid deserts of the Valley, conquer a Kraken in the lakes surrounding the dread Temples of Y'Nagioth or cauterise a Wraith in the Black Tower. In fact live out the fantasies you've only dared dream about. **BUT BEWARE . . . more die than live to tell the tale!**

You've read the program (Computing Today — April '82) . . . Now buy the tape. PET, TRS-80, BBC and Sharp tapes are available at £9.95 per tape plus 50p postage and packing. (16K minimum . . . Commodore PET (New ROMs), TRS-80 Model 1, Level 2, BBC Model B and Sharp MZ-80K. Fill in the coupon below and return it to CT Software, ASP Ltd., 145 Charing Cross Road, London WC2H 0EE and become one of the first to play . . . The Valley . . .

Please send me . . . tape(s) of The Valley PET TRS-80 Sharp BBC at £9.95 per tape plus 50p postage and packing.
I enclose my Cheque/Postal Order/International Money Order for: (delete as necessary)

£ (Made payable to ASP Ltd)

OR Debit my Access/Barclaycard
(delete as necessary)



| | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|



Please use BLOCK CAPITALS

Name (Mr/Mrs/Miss)

Address

Postcode

Signature..... Date.....

82/4

Please allow 21 days for delivery

Computing Today Software

io systems ltd.

A/D BOARD FOR NASCOM

- ★ 8 Bit resolution
 - ★ 8 Input channels
 - ★ 30 microsecond conversion
 - ★ Prototyping area
 - ★ Sample and hold
 - ★ Overvoltage protection
 - ★ Full flag/interrupt control
 - ★ Built and tested
- Price £135 + 15% VAT (post free)

EPROM PROGRAMMER

- ★ Programs 3 rail: 2708/2716
 - single rail: 2508/2758, 2516/2716, 2532/2732
 - ★ Zero insertion force socket
 - ★ Built and tested
- Price £63 + 15% VAT (post free)

GRAPHICS BOARD FOR NASCOM

- ★ 384 (H) x 256 (V) very high resolution graphics display
 - ★ Fully bit-mapped
 - ★ Full software control
 - ★ Graphics software supplied
 - ★ Mixed text and graphics
 - ★ NASCOM 2 or 4mhz NASCOM 1
 - ★ Built and tested
- Price £55 + 15% VAT (post free)

GRAPHICS BOARD SOFTWARE

- ★ Lunar lander: £6 + VAT (post free)
- ★ Graphdraw: £8 + VAT (post free)

DUNCAN

- ★ Fast real time interpreter/control language for NASCOM 1 or 2 (please specify machine)
- Price £12 + 15% VAT (post free)

MONITORS

- ★ BMC 12" green phosphor
 - ★ 18 mhz bandwidth
- Price £175 + 15% VAT (carriage extra)

MEMORIES

- ★ 4116 - 150ns 95 pence each + VAT (min order 8)
- ★ 64K - 200ns £10 each + VAT

6 LALEHAM AVE, MILL HILL, LONDON NW7 3HL

TEL: 01-959 0106



ZXCHESS



TWO GREAT ZX81 16K CHESS GAMES

ZXCHESS(ENHANCED)

- ★ Written totally in machine code.
 - ★ Full graphic display of Chess board.
 - ★ Six levels of play: Two play within competition time limits.
 - ★ Option to play Black or White.
 - ★ Plays all legal moves including castling and en-passant.
 - ★ Cassette routines for saving unfinished game and returning to later.
 - ★ Displays moves of game on screen or printer for analysis.
 - ★ Print a copy of the Chess board onto the printer.
 - ★ Board can be set up in any position, you can even swap sides midgame.
 - ★ clear whole board with one command: for end game analysis.
- £6.50

ZXCHESS II We believe the strongest ZX81 Chess game as no other has beaten it!!

- ★ All the features of ZXCHESS plus:
- ★ Book of 32 opening moves.
- ★ Seven levels of difficulty: FOUR play within competition time limits.
- ★ A move is suggested by the ZX81 if wanted.
- ★ Optional Full Graphic version using the QS CHRS Board.

£12.99

2 copies supplied on cassette with full instructions.
Cheques and postal orders payable to:

ARTIC COMPUTING

396 James Reckitt Avenue
Hull, North Humberside
HU8 0JA.



Happy Memories

| Part type | 1 off | 25-99 | 100 up |
|-------------------------|-------|-------|--------|
| 4116 200ns | .95 | .85 | .70 |
| 4116 250ns | .90 | .80 | .60 |
| 4816 100ns for BBC comp | 3.30 | 2.95 | 2.70 |
| 4164 200ns | 6.15 | 5.25 | 4.65 |
| 2114 200ns Low power | 1.25 | 1.15 | .95 |
| 2114 450ns Low power | 1.20 | 1.10 | .90 |
| 4118 250ns | 3.45 | 3.15 | 2.65 |
| 6116 150ns CMOS | 4.95 | 4.45 | 3.65 |
| 2708 450ns | 1.95 | 1.90 | 1.80 |
| 2716 450ns 5 volt | 2.25 | 2.15 | 1.95 |
| 2716 450ns three rail | 6.40 | 6.00 | 4.95 |
| 2732 450ns Intel type | 4.25 | 3.95 | 3.35 |
| 2532 450ns Texas type | 4.25 | 3.95 | 3.35 |

| Z80A-CPU | £4.75 | Z80A-PIO | £4.25 | Z80A-CTC | £4.25 |
|-------------------------|-------|----------|-------|----------|-------|
| Low profile IC sockets: | | | | | |
| Pins | 8 | 14 | 16 | 18 | 20 |
| Pence | 9 | 10 | 11 | 14 | 15 |
| | | | | 22 | 24 |
| | | | | 18 | 28 |
| | | | | | 33 |

Soft sector floppy discs per 10 in plastic library case:
5 inch SSSD £17.00 5 inch SSDD £19.25
5 inch DSDD £21.00 8 inch SSSD £19.25
8 inch SSDD £23.65 8 inch DSDD £25.50

74LS series TTL, large stocks at low prices with DIY discounts starting at a mix of just 25 pieces. Write or 'phone for list.

Please add 30p post & packing to orders under £15 and VAT to total. Access & Barclaycard welcome, 24hr service on (054 422) 618. Government & Educational orders welcome, £15 minimum. Trade accounts operated, 'phone or write for details.

Happy Memories (CT), Gladestry, Kington,
Herefordshire HR5 3NY. Tel: (054 422) 618 or 628.

WARD ELECTRONICS



SALES AND SERVICE



The powerful and versatile Apple II for Business, Education and Leisure. Excellent handbooks cover all aspects of the system. Expansion capability allows system to grow to meet your needs. TV compatible with UHF Modulator.

Let us quote you for your Apple needs, disk drives, software etc. Epson printers C12 cassettes 55p ea. Discs £2.95 ea. Video monitors for Apple/TRS80 etc. from £77.40

GENIE SERIES COMPUTERS



VIC JOYSTICK £6.50
VIC 20 £165 + VAT = 189.95
VIC Peripherals

Prices start at £270

Molimerx software for Genie/TRS80

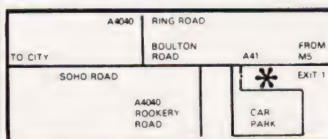
- * Programs
- * Books
- * Games
- * RAM Packs
- * Mini Floppy
- * Disc Units
- * Game Paddles
- * BASIC Course
- * Advanced Programming Course
- Expansion box down in price 32K box £200
- Disc drives EG400 £220 Genie/TRS80

Computer Books — popular titles for programs, games, business, education and systems design.

PLEASE ADD VAT TO PRICES AT APPLICABLE RATE

9am-5pm Tues-Sat.
Closed Mondays.

WARD ELECTRONICS



First Floor
Soho House,
362-364, Soho Road,
Handsworth,
Birmingham B21 9QL.
Tel. 021-554-0708.

With the BBC Micro at last beginning to become available in reasonable quantities, the market for books on the system seems to have taken off in a big way. We review some of the offerings currently available.



The BBC Computer Literacy project has been with us for some months now but I imagine its impact is likely to be cumulative rather than a seven day wonder. As time goes by, more and more people will have seen Chris Serle, Ian McNaught Davis and Gill Nevill bringing the wonders of computer technology into our living rooms.

The BBC publication, **The Computer Book**, doesn't accompany the TV series in the sense of being directly linked to it but it does introduce the subject in a rather similar way. It puts the subject into a wide ranging context. It also tends to introduce the subject by the back door as if there was something not quite proper in being enthusiastic about computers — but then of course not everybody is excited about computers and there are still a lot of people suspicious of them.

The style of the beginning part of the book seems intended to woo the computer-shy, and even the computer-phobes, into sufficient confidence to delve further into it. However, it is unfortunate that the boldness of the title (proclaiming, without further ado, that it is about *the* computer) may dissuade this particular audience to open its covers.

Among the people who are likely to buy it, however, are those who have a genuine interest in computers but don't know the first thing about them. How are *they* likely to respond to it? Well, they may feel that it's rather hard work initially to find the real matter of the book — the first chapter takes the reader from weather satellites via tin cans to washing machines before computers *per se* are really introduced. Once they find their bearings, however, those who read this book are

likely to agree with me that it really does cover a lot of ground in a pleasant and relaxed fashion and that everything needed to introduce the subject of computing is there and well explained.

What about those of us who already know quite a bit about computers — the ones who range from enthusiastic to frankly fanatical. With a title like that you'd expect it to appeal to the computer-ophile. Speaking as one of this growing group (!* Ed) I liked the gentle introduction, which puts computer technology into a wider context than I normally contemplate. The explanation of BASIC is a refreshing one giving a rather different insight into programming; I also enjoyed the discussion of further and future developments in the final chapter.

In conclusion, **The Computer Book** does not actually introduce anything new but wraps up all the

BOOK PAGE

essential points, plus quite a few extra ones, in an attractive style. Good use is made of the second print colour — a cheerful red — allowing flow diagrams and programs to stand out well from the surrounding text. There are lots of photographs and last, but by no means least, there is a family of very appealing bird characters used to illustrate the book who certainly kept me amused.

There *is* a direct connection between the National Extension College's **30 Hour BASIC** and the BBC Literacy Project in that this course has been specially written for the project and is being promoted in conjunction with the television series. It does not, however, rely in particular on the BBC Micro. Indeed, the introduction to the book suggests that you can do the course without a computer at all!

In some ways, this leads to a weakness in the book as far as those who do have access to a machine are concerned. It leads to a tendency to tackle the subject in a long-winded way concentrating on theoretical issues rather more than other BASIC instruction manuals. Having said that, its concentration on flow charts means that it does teach you more than how to write programs — it teaches you how to write good, clear logical programs.

You can follow this course as an NEC correspondence student; the publication has the unmistakable hallmark of a coursebook — it is methodical and has a style which could be described as 'sober'. This is by no means intended as a criticism. There are plenty of alternative texts to choose from if you want to learn BASIC and many of them take flippancy to a distracting extreme! Lots of people do prefer less jokey explanations and this particular text will appeal if you favour a disciplined approach.

Neil and Pat Cryer have also produced an introductory book on BASIC to link with the BBC's computer literacy project and is specifically intended for use with the BBC Micro — a machine they are obviously enthusiastic about. Their book, **BASIC Programming on the BBC Microcomputer**, is approved by Acorn (who manufacture the BBC Micro) and they were helped by those concerned with the machine's hardware and software in its preparation, so it has been tailored to the peculiarities of BBC BASIC.

This is a well written introduction to BASIC, the explanations are

clear and there are plenty of sample programs. It is a practical book as its format makes obvious — there are frequent sections devoted to 'activities' which the reader is expected to do. Another feature is that toward the end of each chapter there is a section entitled 'Some points to think about'. This is invariably followed by a section called 'Discussion on the points to think about' which gives you the solutions to the problems posed. It is rather a shame that these two sections are not separated as, unless you make an effort to hide the answers, you are tempted not to think through the problems for yourselves.

The final section of each chapter is a discussion of the activities suggested earlier and is intended to consolidate what should have been learnt through them. This is particularly helpful as it draws attention to many points, both major and minor, which otherwise might have escaped notice.

Special features of BBC BASIC are covered — there are two chapters on its graphics, one on animation and one covering programmable characters and sound. Personally, I would have liked to have seen more attention paid to sound and to the ENVELOPE command which is an interesting way of defining irregular sounds. Also, I would have expected a book focussing on BBC BASIC to have paid more attention to the user-defined procedures. This is only introduced very near the end of the book whereas, had it been discussed earlier, programming examples in the areas of graphics, mathematical functions and string handling, could have been made simpler and more generalised by using procedure calls and procedure definitions.

All in all, the Cryers and Prentice-Hall International have done well to produce a book on the BBC Micro so quickly. It is an introductory volume so let's hope they go on to produce another one for the more advanced level — and please include more of the drawings of the 'absent-minded professor' character next time.

Sigma's title for the BBC Micro and the Acorn ATOM, **Practical Programs for the BBC Computer and the Acorn ATOM**, is a nicely presented and clearly laid out paperback *but* it is rather slim. There are three or four programs in each chapter, each of which is presented in two versions — the first for the BBC machine (in which good

use is made of procedure calls) and the second for the ATOM.

The structure of the programs is clearly indicated by the use of one or two line explanations printed as boxed headings above the relevant section of code. Chapter one contains three very short and rather traditional games programs which do not make special use of any of the BBC Micro/ATOM's special features. Chapter two is entitled 'Graphs' but the programs it contains are not for histograms or plots but instead draw beautiful patterns on the screen. Again, they are very short routines. Chapter three has three programs for word games and one for cataloging records, telephone numbers, book titles, etc. There are three programs in Chapter four: the first carries out arithmetic in traditional fraction form rather than in decimal numbers; the second simplifies polynomials; and the third is a Reverse Polish calculator — which seems a bit esoteric until you realise it will enable you to do your sums to unlimited accuracy.

Chapter five is by far the most interesting of the book and is also the longest. It presents an SPL compiler for which the complete code is given. SPL stands for Simple Programming Language so Johnson-Davies is providing another high level language for the BBC Micro and the ATOM. More importantly, he gives an excellent example of how to write a simple compiler.

The books included in this month's selection were:

The Computer Book by Robin Bradbeer, Peter De Bono and Peter Laurie, published by BBC Publications (1982), 208 pages, £6.75.

30 Hour BASIC by Clive Prigmore, published by the National Extension College (1982), 254 pages, £5.50.

BASIC Programming on the BBC Microcomputer by Neil and Pat Cryer, published by Prentice Hall International (1982), 208 pages, £5.95.

Practical Programs for the BBC Computer and the Acorn ATOM by David Johnson-Davies, published by Sigma Technical Press, distributed by John Wiley & Sons Ltd (1982), 120 pages, £5.95.


It's easy to complain about advertisements.

Every week, millions of advertisements appear in the press, on posters or in the cinema.

Most of them comply with the rules contained in the British Code of Advertising Practice and are legal, decent, honest and truthful.

But if you find one that, in your opinion, is wrong in some way, please write to us at the address below.

We'd like you to help us keep advertising up to standard.

The Advertising Standards Authority. 
If an advertisement is wrong, we're here to put it right.

A.S.A. Ltd., Brook House, Torrington Place, London WC1E 7HN.

REMOTE 'MICRO' CONTROL

Control domestic or office appliances with your micro without the need for wiring.

By using just one TX 008 you can link your micro to remote RX 018 anywhere in your home or office. This interface system works with any micro (Apple PET ZX81 etc.)

● TX 008 COMPUTER INTERFACE

The TX 008 is the link between your micro and any remotely located RX 018. Its function is to pass instructions from your micro to defined remote points. The TX 008 is simply plugged into the mains and connected to an output port of any micro computer.

The TX 008 comes complete with output port connections, drive software and application examples.

ZX81 users require an extra input output port module not included in the TX 008 price see code no ZX81 CP.

TX 008 price £45.00 inc. VAT

● RX 018 REMOTE TX INTERFACE

The RX 018 carries out instructions passed to it from your micro via the TX 008 as with the TX 008.

No wiring is necessary just plug your RX unit into any convenient mains socket and plug in the appliance.

Your micro now has control

Price £25.00 inc. VAT

Stripeland Ltd., 111 Liverpool Road, Formby, Merseyside L37 6BR.

● ST KIT STARTER KIT

The St KIT is a standard starter kit containing one TX 008 and two RX 018. For further expansion of your system you only require more TX 018's.

St kit price £85.00 inc. VAT

● CONTROL PANELS

Control panels for interface with RX 018 are available, for further details and prices tick box provided on order form.

Order Form

TO:

Stripeland Ltd., 111 Liverpool Road, Formby, Merseyside L37 6BR.

Please send me items listed.

I enclose a cheque/postal order for £

Please add £2.50 P&P to your calculated total.

Name

Address

.....

CT / 6 / 82

Important — Please state type and make of computer

| Qty | Type | Price Each £ | Total |
|-----|--------|--------------|-------|
| | TX 008 | 45.00 | |
| | RX018 | 25.00 | |
| | ST Kit | 85.00 | |
| | ZX81cp | 13.90 | |

Total _____

Please send me details of

1. St control panel

2. Super Control panel

CT STANDARDS

If you've ever wondered just what those funny symbols in other people's programs mean you need our standard codes.

It has been very encouraging to see the number of programs submitted using our standard codes for graphics and other non-printable characters. However, it has also become increasingly clear that some of our readers haven't heard of them and this page is intended to set them out once again.

All standards tend to be irksome to adhere to but the ones laid out here are fairly simple and tend to make software easier to maintain by the programmer and simpler to understand for others.

Controlling That Cursor

It is fair to admit that the standards arose because, in the early days, we had a printer which could not reproduce the graphics characters produced by the PET (among others). One soon learned that a mysterious '3' appearing in the listings actually meant 'clear screen' but many of the other characters simply disappeared making documentation extremely difficult.

The original standards that emerged were simply aimed at getting round this problem and it is a tribute to their simplicity that they are becoming widely accepted. (Indeed, a whole series of books is using them as its de-facto standard.) The standards for the cursor controls are given in Fig. 1.

| | |
|-------|------------------|
| [CLS] | CLear Screen |
| [HOM] | HOme the cursor |
| [CL] | Cursor Left |
| [CR] | Cursor Right |
| [CU] | Cursor Up |
| [CD] | Cursor Down |
| [REV] | REVerse video on |
| [OFF] | Turn it OFF |
| [SPC] | SPaCe character |

Fig. 1. The original cursor control codes which are still doing sterling service.

To indicate more than one of the above, an optional number can be placed within the brackets; [4 CL], etc.

The use of square brackets has raised one or two interesting queries. The actual reason for this choice is that *most* of the common microcomputer BASICs don't use them for specific functions. In fact, at least one machine provides an added bonus by returning a syntax error if they are found, a useful check

in case you type them in by mistake.

The code [SPC] was added to the list of cursor control codes to get over the problem of indicating just how many spaces are contained in that gap in the printout. It is interesting to note that when the National ZX81 Users' Club published a set of programming standards specific to that machine, they found the same problem. The code they chose to use was '3'.

The code [RVS] has caused a few headaches. This is really specific to the PET where the character set can be displayed in reversed video. On machines which don't have this facility you should either find a character in the set which is the reversed image of the one you want and use that or simply ignore it and use anything else you fancy! Don't forget, you may have to look up and alter the values used elsewhere in the program.

The Graphic Solution

It soon became obvious that the techniques applied to the confusing cursor controls could also be applied to the graphic symbols. The following standard is now in general use in programs published in Computing Today.

If a graphics character or characters are to be displayed in a listing (as opposed to POKE codes or CHR\$() codes) then they are indicated by the method shown in Fig. 2.

Several people have asked what the relationship between the POKE value for a character and that of its shifted graphic might be. In general the shifted version of any character will be 64 greater than the value of that character. This applies to both

PET and MZ-80K systems in all cases.

This can be taken further to include machines which use a pixel graphics set rather than pre-programmed PET-style characters and the series of codes for these is given in Fig. 3. As is nearly always the case there is one machine to which the standard shown in Fig. 3 does not apply — Tangerine's Microtan/Micron. This machine uses a four by two cell structure for its pixel graphics instead of the Prestel/Teletext three by two cell. The method for calculating the value to assign to 'P' is shown in Fig. 4, and is fortunately nice and simple.

Making REMarks

Many people scorn the use of REMs within programs but, during the development at least, they are extremely useful. One of the documentation methods that we use is to keep our back-up copy of our programs on a 300 Baud CUTS tape with all the REMs in place: the working copy, be it on tape or disc, is REMless in order to save space.

It is also good programming 'manners' to give your REMs odd line numbers:

```
3999 REM ** CRASH PROOF INPUT
4000 INPUT "THE NUMBER OF ENTRIES ";AS
```

A remarkable number of submitted programs have jumps that go not to the relevant point in the program, but to the REM statement. This can cause severe problems when re-numbering after removing the REMs. The format in which we publish the REMs is shown in the previous example; two asterisks between the REM and the comment with the latter in capitals.

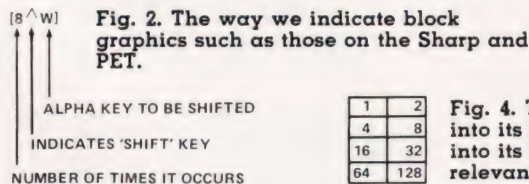


Fig. 2. The way we indicate block graphics such as those on the Sharp and PET.

Fig. 4. To convert a Tangerine pixel code into its blocks, simply decode the number into its binary or Hex value and fill in the relevant squares.

| | | | | | | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| [P0] | [P1] | [P2] | [P3] | [P4] | [P5] | [P6] | [P7] | [P8] | [P9] | [P10] | [P11] | [P12] | [P13] | [P14] | [P15] |
| [P16] | [P17] | [P18] | [P19] | [P20] | [P21] | [P22] | [P23] | [P24] | [P25] | [P26] | [P27] | [P28] | [P29] | [P30] | [P31] |
| [P32] | [P33] | [P34] | [P35] | [P36] | [P37] | [P38] | [P39] | [P40] | [P41] | [P42] | [P43] | [P44] | [P45] | [P46] | [P47] |
| [P48] | [P49] | [P50] | [P51] | [P52] | [P53] | [P54] | [P55] | [P56] | [P57] | [P58] | [P59] | [P60] | [P61] | [P62] | [P63] |

Fig. 3. The standard pixel codes; they will work on most computers which this technique as well as for Teletext and Prestel.

COMPUTAMART

AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE...

COMPUTING TODAY
PRESENTS YOUR OWN
'WHERE TO BUY IT' GUIDE.

AVON

DATALINK MICRO COMPUTER SYSTEM LTD
10 Waring House, Redcliffe Hill,
Bristol. Tel: (0272) 213427.
Open: 6 days 9.30am-5.30pm (Sat 1pm).
*Retail and Wholesale (C.R.A. member)

MicroStyle

29 Belvedere, Lansdown Road,
Bath.
Tel: 334659.
Open: 6 days 9am-5pm. late night Thur 9pm.

radan COMPUTATIONAL LTD
Commodore Computer Centre
19 Belmont, Lansdown Road,
Bath. Tel: 318483.
Open: Mon-Fri 9am-5.30pm.

BEDFORDSHIRE

BROADWAY ELECTRONICS
1 The Broadway, Bedford.
Tel: 0234 213639.
Open: 6 days 9am-5.30pm. (lunch
1.30-2.30 ½ day Thur). We supply
ACORN ATOM computers.

CHESHIRE

northern computers Churchfield
Road,
Frodsham.
Tel: (0928) 35110.
Open: 6 days 9am-6pm.
Retail & Wholesale.

 **BBC**
Apple Acom

CLEVELAND

D. BRUCE Electronics
The Beacon,
Blackhall Rocks, TS27 4BH.
Tel: Peterlee 863612.
Mail order. Retail & Wholesale.
Hardware for ZX80/81.

BRIERS COMPUTER SERVICES
Polytechnic Bookshop (at the Poly)
1 King Edward Square,
Middlesbrough.
Tel: 0642 242017.
"Everything for the Genie computer".

LOOKING FOR
MICROCOMPUTER HARDWARE
OR SOFTWARE? LOOK NO
FURTHER THAN
COMPUTAMART!

ESSEX

EMPRISE
EMPRISE - TANDY
58 East Street, Colchester, Essex.
Tel: 0206 865928
Open: Mon-Sat 9.00am-5.30pm.
Branches at Chelmsford.

J. M. PICKARD
Micro Computer Services
22 Holland Rd, Clacton-on-Sea
Essex CO15 6EQ
 **apple** Tel: 0255 29018 **genie**
video genie centre.
Demonstration by appointment.

GLOUCESTERSHIRE

R & R SOFTWARE 34 Bourton Rd.,
Gloucester GL4 0LE.
Tel: Gloucester 502819.
ZX81. Mail order. Callers by
appointment. Dealer enquiries welcome.

HAMPSHIRE

XITAN SYSTEMS 23 Cumberland
Place, S'hampton
Tel: (0703) 38740. (C.R.A. member)
Open: Mon-Sat 9.30am-5.30pm (Sat 1pm)
OSBORNE in stock.

HERTFORDSHIRE

ALPHA BUSINESS SYSTEMS
Church St., Industrial Area, Ware.
Tel: 0920-68926/7.
WIG 20 (C.R.A. member).
Main Commodore Systems Dealer.

COMPUTER PLUS


47 Queens Road, Watford.
Tel: 0923-33927.
Open: 6 days, 9.30am-5.30pm (Sat 9am).
Specialists in:
Commodore, Acorn, Sharp, Texas.

HUMBERSIDE

3-LINE computing
36 Clough Road, Hull.
Tel: 0482 445496.
Video Genie; TRS80 + ZX81 software
Open: 6 days 9 to 5.30.

CALL SHEILA RUTTER ON
01-437 1002 FOR YOUR
BUSINESS TO BE
INCLUDED.

KENT

Bromley Computer Shop
49 Beckenham Lane, Shortlands,
Bromley.
 **apple** **SUPERBRAIN**
Tel: 460-2580 (24hrs)/464-0541.

LANCASHIRE

CTS
31/33 Church St., Littleborough.
Tel: (0706) 79332/74342/73840.
Open: Mon-Sat 9am-5pm. Tel: anytime.
Ohio, Apple, PET + CPM machines.

NJC COMPUTER SHOPS

29 Hanging Ditch, Manchester.
Tel: 061 832 2269
Open: Mon-Fri 9.30am-5.30pm.
Sat 10-5. Retail and Wholesale.

LEICESTERSHIRE

MICROWARE
131 Melton Rd., Leicester.
Tel: Leicester 681812.
Open: Mon-Sat 9.30am-5.30pm.
Closed Thursday.
ZX81 Hardware, Software, Books.

LINCOLNSHIRE

SHARP CENTRE 
16 Melville Street,
Lincoln.
Tel: Lincoln 32379.
Open: 9am-5.30pm closed Wed.

LONDON


BYTESHOP COMPUTERLAND
324 Euston Road, NW1.
Tel: 01-387 0505.
Open: Mon-Fri 9am-5.30pm.
(C.R.A. member)

Personal Computers Limited 194-200 Bishopsgate,
EC2.
Tel: (01) 626 8121.
Open: Mon-Fri 9am-6pm.
Retail and Wholesale.

COMPUTAMART

AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE...

MERSEYSIDE

 **66 Lime St., Liverpool.**
Tel: (051) 708 7100.
Open: 6 days 9am-5.30pm. Video Genie, Acorn Atom, VIC 20, Texas. Hardware + Software (including ZX81).

BUG-BUS

98-100 The Albany, Old Hall St., Liverpool 3. Tel: (051) 227 2842.
Mail order (callers by appointment) ZX81, ATOM and VIC software. Retail and Wholesale.

MIDDLESEX

L.B. ELECTRONICS
11 Hercules Rd, Hillingdon.
Tel: Uxbridge 55399 (24hr ans. service)
Open: 6 days, 9.30am-6pm, (lunch 1-2.15 except Sat)
Surplus equipment, memory, EPROMs etc. Also established mail order service.

W. MIDLANDS

CAMDEN ELECTRONICS
462 Coventry Rd, Small Heath, Birmingham.
Tel: 021-7738240. Telex: 335909.
Open: 6 days, 9am-5.30pm.
Retail & Wholesale (C.R.A. member)

campaign computing

Warwick Chambers,
14 Corporation St., Birmingham.
Tel: 021-632-4029
PET, APPLE + TRS80 level 2 Software.
Mail order + trade enquiries welcome.

MAGRONICS

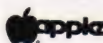
(ZX80/81 Software/Hardware)
26 Spiers Close, Knowle, Solihull B93 9ES.
16K RAM Pack - 3 weeks delivery. Disc Drive - send S.A.E. for details. Mail Order Only.

NORFOLK

ANGLIA COMPUTER CENTRE

88 St Benedicts Street, Norwich.
Tel: (0603) 29652/26002.
Open: 6 days 9am-5.30pm.

the logicshop

Microcomputer Specialists
 **4 Morris Close, Stoke Holy Cross**
CALLERS BY **Norwich NR14 8LL**
APPOINTMENT **Tel. (05086) 2763**

SCOTLAND

BYTESHOP COMPUTERLAND

61 Waterloo St. Glasgow
Tel. 041-221-7409
Open: 6 days 10am-5pm (Sat. 1pm)
(C.R.A. Member)

COMPUTER AND CHIPS
Feddinch Mains House,
St. Andrews, Fife.
Tel: St Andrews (0334) 72569.
Open: 9am-7pm.

VICTOR MORRIS GLASGOW

TANDY TRS 80, VIC 20, VIDEO GENIE, APPLE
PANASONIC, CUMANA, EPSOM ETC.
340 Argyle Street, Glasgow G2: 041 221 8958


STAFFORDSHIRE

MICRO-PRINT LTD

59 Church St., Stoke-on-Trent.
Tel: (0782) 48348.
Open: Mon-Sat 9.30am-5.30pm
(Thurs 12.30pm, Sat 4.30pm).
VIC 20, NASCOM, Books.

SURREY

CROYDON COMPUTER CENTRE
29A Brigstock Road, Thornton Heath
Tel: (01) 688 1280

Open: 9am-6pm, late nights Mon, Tue & Wed
Everything for the microcomputer user.
 *Phone for free catalogue. Unsure what to buy? Why not hire and try?

SUSSEX

BEAVER ELECTRONICS

12 Beach Rd., Littlehampton.
Tel: (09064) 22461.
Open: 9am-5.30pm. Closed Wed + Sat 12.30.
Triumph, Adler & Superbrain computers. Hardware, Software.

CROWN

56-58 South Street, Eastbourne.
Tel: Eastbourne (0323) 639983/20496
Open: 6 days 9am-5.15pm.

GAMER

24 Gloucester Road, Brighton.
Tel: 0273-698424.
Open: Mon-Fri 10am-5.30pm,
Sat 9am-5.30pm.

HOBBYIST LTD.

(Home Computer Centre)
3 The Broadway, Manor Hall Rd., Southwick. Tel: (0273) 593345.
Open: 6 days 10am-9pm (Wed + Sat 6pm) APPLE, VIC 20, UK101.

TYNE AND WEAR

HCCS ASSOCIATES
533 Durham Rd., Low Fell, Gateshead. Tel. Newcastle 821924.
Open: 6 days 9am-5.30pm (Sat 10am-5.30pm). Specialists in: Acorn, BBC, Video Genie, VIC 20.

WALES

COMPUTER SUPPLIES (SWANSEA)

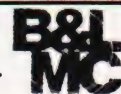
80/82 Gower Road, Sketty, Swansea.
Tel: Swansea 290047.
Open: Mon-Sat 9am-5.30pm.



WARWICKSHIRE

BUSINESS & LEISURE MICROCOMPUTERS
16 The Square, Kenilworth.
Tel: Kenilworth 512127.

Open: Mon-Fri 9am-5pm. ½ day Thur (lunch 1-2). Retail and Wholesale.



YORKSHIRE

BMS + PCS

COMPUTER PRODUCTS LTD
4 Westgate, Wetherby.
Tel: 0937-63744.
Open: Tues-Sat 9.30am-5pm.

BRADFORD'S COMPUTER SHOP

at Thomas Wright (Bradford)
Ltd., Thorite House, Laisterdyke.
Tel: Bradford 668890.
Open: Mon-Fri 8.45-5.30. (Sat 12am)

ELTEC

ELTEC SERVICES LTD
231 Manningham Lane, Bradford.
Tel: 0274-491372.
Open: 6 days 8.30am-5.00pm.
(Sat 10.30-4). BBC



THE LEEDS COMPUTER CENTRE

60-62 The Balcony, Merrion Centre, Leeds.
Tel: 0532-458877.
Open: Tues-Sat 9am-5pm.



ADVERTISEMENT RATES

Semi-Display (min 2 cms)
 1-3 insertions **£7.25** per cm
 4-11 insertions **£6.75** per cm
 12+ insertions **£6.25** per cm

Lineage 30p per word (min 15 words)
 Box Nos. **£2.50**

Closing date 2nd Friday of the month preceding publication date.

All advertisements in this section must be prepaid. Advertisements are accepted subject to the terms and conditions printed on the advertisement rate card (available on request)

Send your requirements to:

COMPUTING TODAY CLASSIFIED
 ADVERTISING, 145, CHARING CROSS RD,
 LONDON WC2H 0EE.

PET UPGRADE

We can upgrade your large keyboard PET at a fraction of the "New Price" difference.

8K to 16K £44.00
 16K to 32K from £56.00
 8K to 32K £69.00

If expansion area drilled with quarter inch holes £10.00 extra

All new RAMs fitted sockets

Fast, 2 hour while-you-wait service.

Tel: Mick Bignell of Miroserve on 01-953 8385.

NASCOM SOFTWARE

6502 cassette assembler under Nas Sys £12 also 5.7K standard Z80 cassette assembler with Nas resets etc. £12; Nas Dos 15K ultimate Z80 assembler £50; 3K cassette word processor £18; Card index/catalogue program cassette £15; 4 function decimal arithmetic module to 254 digits, listing £6.50; Lab control BASIC cassette £6; 2K position independent debug £9 and 2K relocatable disassembler £11 both cassette

Eprom and extended DOS DISK DOS NAS DOS
 DOS
 DOS
 Details SAE please

Mr. P. Watson, 101 Village Road, Bromham, Bedford MK43 8HU.

HAVEN HARDWARE (WINNERS OF THE DAILY EXPRESS/PHILISHAVE BUSINESS AWARD). ZX KITS (S.A.E. for Built prices/Details) 4 Asby Road, Asby, Workington, Cumbria. PROGRAMMABLE GRAPHICS £19.95 (First ever for ZX80/1). Works with printer — no hidden bugs — edge connector not used. Repeating keymodule £3.45. Keyboard £17.50 (P&P £1.00). Edge connector £2.20. Inverse Video/I.O Port/Memory/Colour (Extended sheet available) P.O.A.

APPLE II + 48K 1yr-old 2 disc drives, monitor, printer card, many games, visicalc, information master (org. over £1800) yours £1450 ono. Tel: John 0622-63192 Maidstone Kent.

ZX81 16K WORD-PROCESSOR. Type text directly onto screen; full cursor control; display or print up to ten screens 'N' times; 'graphics' mode; use with or without printer. Supplied on cassette with detailed user guide for only £5.00. K.J.Moore, 99, Raphael Drive, Shoeburyness, Essex.

VIC 20. 5 games; Simon, 4 Row, Othello, Drive Pelmanism on cassette £5 to M.Clark, 'Dingle', Blackpond Lane, Farnham Royal, Bucks.

NASCOM 1/2

Extension Basic £15 (£25 in ROM)
 Enhances ROM BASIC with 30 new keywords. FIND, GET, AUTO, EDIT, CALL, RENUMBER, REDUCE, IF, THEN, ELSE, REPEAT, UNTIL, WHILE, WEND, LINE, WRAP, COPY, XREF, TRACE etc. And you can add more yourself. Only 4K, an interpreter in its own right & a superb toolkit.

Asteroids: fast action in space. Must be seen! £8

Bomber: flatten your least favourite city £5

Fantasy: mythic adventure in a weird mansion £8

Missile Defence: fast action nuclear defence £8

Nightmare Pork: go the whole hog and sty it! £5

Games Collection: Breakout, Gunner, Minefield, Surround and Wumpus on a single cassette £6

FREE P&P, NO VAT. Money back if not happy. Full documentation. (Nascom 1s need Nas-Sys/Cottis B.)

Order or large SAE for ILLUSTRATED CATALOGUE to:

LEVEL 9 COMPUTING, 229 Hughenden Road, High Wycombe, Bucks. HP13 5PG.

ATOM OWNERS

A raster simulator simulating a 480 line display for your machine. £8 inc postage

TELL TALE SYSTEMS
 22 HOLLAND STREET, W-S-M, AVON.

ZX81 BEGINNERS. Don't wait to learn BASIC, start computing **now.** Phone Nick Godwin, 0390 50965.

VIDEO GENIE eight months old. Many books, some tapes. Quick sale £230. Ring 859 4780.

UK101 6502 EMULATOR (8K). Run assembler/machine code in slow motion. Current instruction, registers, memory and stack continuously displayed. Ideal for understanding machine code or software testing. Easy to use. Cassette, full instructions, examples £5.90. State monitor. B.Beckett, 33 Lynwood Drive, Stalmine, Blackpool.

MZ-80K MUSIC and sound effects. Five programs (20K) on cassette. "CHIP-SONGS" — lively jigs and reels. "BIRD-SONGS" very realistic, always different! "ENGINES" — millions of variations. "CHIPSONG GENERATOR" — composes tunes, spontaneously!! "WEIRD MUSIC" — demonstrates POKE and USR. All for £9. G.B.James, Flat 6, 21 Lamond Place, Aberdeen.

ZX81 (16K) DISABLED If you have the ZX printer and Technomatic port, you can type and draw using either one or two pad switches. Drawings are also stored on tape automatically. Plus simplified versions of 'Space Invaders' and 'Road-Race' (operated by pad switches). Ideal for schools and institutions. For two cassettes and instructions send £7.80 to: Second Foundation, 22 Bramber, Belgrave, Tamworth, Staffs B77 2LL.

ZX81 ARCADE GAMES 4K machine code. SUICIDE MISSION (Scramble) three phases, obstacles, missiles, alien installations, bombs and laser. GUNFIGHT for 1 or 2 players. SPACE INVADERS 49 aliens, flying saucer. GALAXY INVADERS random moving aliens. ASTEROIDS blast through asteroid belt. Top quality. £3.95 per program on tape or send sae for details. J. Steadman, 6 Carron Close, Leighton Buzzard, Beds. LU7 7XB.

THE REAL ADVENTURE BEGINS HERE — for Nascom owners with NAS-SYS. Send SAE for details on our versions of the classic mainframe Adventure (Nascom Approved Product) to: SYRTIS SOFTWARE, 23 Quantock Road, BRIDGWATER, Somerset.

16K ZX81 — brand new, with lots of very good software. Only £120. Also a 20 inch mono only £20. Royston 46042.

***** FREE *****

ZX81 INVADERS (16K)
 Send S.A.E. for free listing of 4K M/C code space invader program to
 J. Edmonds, 29 Chestnut Ave,
 Grays, Essex.

LUTTERWORTH SOFTWARE
 6 Cromwell Close, Walcote, Lutterworth,
 LE17 4JJ

VIDEO GENIE & TRS 80 (Level 2)

Three more superb utilities — only £6 each (incl.)

****COPIER****
 Loads below 42E9H and copies a SYSTEM program to tape (either cassette) without entering addresses.

****KEYDEF****
 Define your own single key entries. 52 available, up to 15 chars each, then store to tape.

****M/C TO BASIC****
 Convert a machine code program or routine to BASIC DATA lines. (16K or 32K — state which).

Send SAE for full catalogue. Prompt service.

OTHER **CENTRONICS** DEALERS
Would try to add 15% VAT
to **OUR PRICES**

737 - £347 + VAT = **£399** . .SAVE **£60!**
739 - £434 + VAT = **£499** . .SAVE **£80!**

Optional Serial Interface £50
Orders & Information Requests to:-

PSYCHOSOFT, Triggabrowne,
Tiford Road, Rushmoor, Farnham,
Surrey GU10 2RJ.

MURGATROYS
by collins

ZX81 **ZX81**

From the depths of the Inland Revenue they come to torment you in TWO exciting games -

MURGATROYS (8K) - you are being chased by the fiendish black Murgatroyds, can you blow them up before they get you? National high score 250 by P. B. of Stratford £4.95

MURGATROYD'S REVENGE (14K) - they are back on the warpath in this brand new interactive maze game, contains that element of surprise so few games have, can you find the key to the door and escape? I doubt it. WARNING: not to be played at night. £4.95 both £7.40

Now you can see (and buy) **MURGATROYDS** in the Midlands at **Microware, 131 Melton Road, Leicester**. Or by post from: **Collins Computing, The Gatehouse, Whinburgh, Dereham, Norfolk**.

COMMODORE TRACTOR PRINTER 4022 series latest model less than 1 year old. £395 new accept £250 ONO. Tel: 0299 250352.

ACORN ATOM 8K £150 12K £250 new. Guaranteed including postage software special low prices (01)368-0572.

SHARP PC-1211 and printer for sale. Sound condition £145 o.n.o. Phone Barry 01-434-1365 working hours.

DISKETTES 120 x 8in. single head single side 32 sectors single density £3 each £300 lot. Mag ledger card holder £15 Tel: 01-310 3533.

ZX81 16K PRINTER 3-D high resolution graphics (fast M/C program) cassette £3.50 hangman, pontoon (superb graphics) cassette £3.50. P.J. Malsbury, 37, Alexandra Ave, Mansfield, Notts.

ATOM UTILIROM 1

Extend your ATOM with these useful routines. Simply plug rom into the spare socket in your atom. No other mods needed.

COMPACTOR Removes all REMs/spaces. Abbreviates INPUT, PRINT, GOTO, GOSUB etc. Up to 20% more memory saved.

RENUMBER Basic lines open or close.
KEYBOARD SCAN Ideal for games. Checks for keypress without wait.

MACHINE CODE MONITOR Examine or change memory locations run machine code programs etc (without basic).

DISASSEMBLER A complete disassembler converts object code into source code as per ATOM format. All This At A Price You Can Afford Only £7.95 incl.

EPROM PROGRAMMER for 2516/2716/2532/2732. Program any single, multiple location or complete EPROM in under 2 mins. Uses 6 cheap TTL ICs for complete reliability. Software supplied for 6502, 6800, 280 plus flowcharts circuit, full instructions and fibreglass P.C.B. Only £13.75. Software available for 6800, 6502, 280 send 50p for catalogue.

J.MORRISON (MICROS), 2, GLENSDALE STREET, LEEDS LS9 9JJ. TEL:(0532) 480 987

ACORN ATOM 12 + 12K, built by Acorn, 10 months old, perfect condition, plus four Acorn Software Packs - all for £220 also 9" VDU £50 will demonstrate, RAM test etc. Phone 01-390 4287.

APPLE Video-Genie, Pet, Vic, ZX81. **TIRED OF THAT PROGRAMME? NOT WHAT YOU WANTED?** Cash up to 50% off current list for cassette, disc or Rampac in immaculate condition with full documentation. Send, with address and return postage, for prompt appraisal to Dr D Graham, 17 Hastings Rd, Bexhill-on-Sea, E. Sx. TN40 2HJ.

NASCOM II VOICE SYNTHESIZER Based on the single chip Vortrax SC-01, gives unlimited vocabulary via phonemes. Only £49.95. M. Lancaster, 8 Cavendish Place, Bath, Avon.

TEXAS T199/4A (SLARI) A fast action game. Try to trap your opponent with your snakes trail before he does. Colour graphics and sound. £4.50 inc. postage, Michael Yates, 42 Rose Lane, Chadwell Heath, Romford, Essex.

SINCLAIR 16K RAM pack used twice plus sync. magazines all for £35. Phone 0303-56266.

CASSETTES High quality C-15 with case and labels. 10 for £5 all inclusive. Blackcat Electronics, 70 Kingston Road, Leatherhead, Surrey. 07373-60439 Trade Enquiries Welcomed.

ZX80/81 KEY BLEEP UNIT

Keyboard entry problems solved with a 'Key-Bleep' audible sound module, fits to the expansion socket and provides an audible tone on each keyboard entry. £9.95 or kit £8.85 inc. p&p. Instructions provided. Optional connector £2.35

SS50-SS30 EXTENDER CARDS

Make it easy to work on those printed circuit boards. SS50 - £9.95
SS30 90° £8.75. SS30 straight £7.75. All ready built with connectors.

6800/6802 SYSTEM OWNERS

Super monitor program giving many extra commands. Hexadd, Ramcheck, Blockmove, Trace plus many more useful functions. Supplied in 2 x 2716 proms also full user manual. Prom F000H, Ram A000H Serial I/O 8000H, but can configure as required. State when ordering £13.80. All prices include p&p and V.A.T.

MICROTRONIX, 3 Buxton Avenue, Carlton, Nottingham, N94 3RR. Tel:0602-872496

HORSE RACING. ZX 81 - 16K, TRS -80 Level II, Video-Genie. Marshals data from newspaper, evaluates it to make a selection. On one seasons hurdles we ended 84.89 units up! £7.50 SIDELINES, FREEPOST, OXFORD OX2 8BR.

ZX80 & ZX81 16K RAM Board with 24 programmable I/O lines. Bare board £10.50 inc. p&p. 4K RAM/8K EPROM board with 24 programmable I/O lines. Bare board £10.50 inc. p&p. C. Dobson, 22 Grymesdyke Way, Colchester, Essex CO3 5QT.

TRS80 Level II 16K plus peripherals £325 ono also Acorn Atom 12K £200 ono. 01-855-1411 eves.

ZX81 Eight superb 1K listings £1.00 + large sae to Comsoft, 36, Linwood Crescent, Ravenshead, Nottinghamshire.

VIDEO GENIE 16K LII. Sound. Joysticks. Monitor B/W. Books. Manuals. Software. v.g.c. £350 o.n.o. Tel.0234-741169.

VIDEO GENIE PROGRAMMES 1) Rental control system (eg TV.rentals) £4.50. 2) "mastermind" £3.50. The two for £6.00. 50p p&p. Atlas Electronics, 577 Spring Bank West, Hull, HU3 6LD.

"GRAFIX"

ZX81 image manipulation program (16k) Cassette: £3 Listing: £2 Details: s.a.e. Nick Godwin, 4 Hurkur Crescent, Eyemouth, Berwickshire, TD14 5AP

TANGERINE MICROTAN Tanex 8K RAM basic XBUG ASCII KYBD P.S.U. £220 Phone Clarke 01-580-4468 (2868) Day.

ATTENTION TANGERINE OWNERS. IBM GOLFBALL TYPEWRITER with interface board and power supply all leads, plugs, programming just plug straight in ideal small business that needs letter quality printing £433 inc. VAT & carriage, will interface to any computer with VIA port, SAE to Ralph Allen Eng. Forncett-End, Norwich.

MZ-80K SALES Program. Cassette based includes invoicing, statements & VAT. Send SAE for full details to D.M. Bellwood, 8 Barlow Rd, Sheffield S6 5HR.

ZX81 Sophisticated software. L Text based on my successful word processor, Ztext, Ltext prints (on the ZX printer) an enhanced character set, including LOWER CASE LETTERS. Elegant screen editor, formatter/printer justifies, indents, pages etc. (£8). Ztext - as Ltext but without extra characters (£5). Matrix Planner: a versatile and powerful on-screen financial modelling system employing VisiCalc concepts. Allows complex business planning, 'what-if' analysis, home budgeting, etc. (£5). From Graham Asher, 60 Maryland Road, London N22 5AN. (Cassette, instructions.)

ATOM UTILITY ROM £19.95

The Willow Software 4K Utility ROM simply plugs into the spare utility socket in your Atom and provides 18 powerful new commands and facilities including: Full Renumber, Range Delete, Find, sophisticated Auto line numbering, Program compression, Disassembler, true Keyboard Scanning, Memory Dump, Variable Dump, Register Dump, Keyboard sounder and much more. The Utilities are professionally written and fully tested. All standard Atom facilities are unaffected, and no text-space memory is used.

Send cheque/PO for £19.95 for delivery by return of post, or write for further details

WILLOW SOFTWARE
PO BOX 6, CREDITON, DEVON EX17 1DL

CASIO FX702P PLUS MANUALS, mint condition £75.00 including postage. Lamb, 131 Victoria Rd., Scarborough, Yorks.

ZX81 USERS' CLUB

Make the most of your ZX81 by joining the largest (and oldest) ZX Users' group, the National ZX80 and ZX81 Users' Club. Each month we publish the club magazine INTERFACE, with lots of programs, contact addresses, software and hardware reviews, hints, tips and club members' letters - along with special members' offers. Sample copy of INTERFACE, £1.

National ZX80 and ZX81 Users' Club, Dept. CT, 44-46 Earls Court Road, London W8 6EJ.

ZX81 SOFTWARE 16K

Supplied on tape with full instructions

DATABASE A business system which can be used for mailing lists, stock control, telephone directory etc. Hundreds of uses. **£10**

ACCOUNTS Keeps up to date track of all your private or business transactions. Many useful functions included. **£6**

TELETEXT Sets up pages of information under your own headings. Instant access to all the data you require. Use is only limited by your imagination. **£6**

MESSAGE DISPLAY Continuous moving display of your message in large letters. Eye-catcher for shop windows. Fun for parties. **£4**

Send SAE for full details of these and many other interesting programs.

Datafax (DEPT. CT)
Riviera House, Queens Road, Buckhurst Hill, Essex.

Trade and Overseas enquiries welcome.

TRS80 — VIDEO GENIE: an exciting new range of software games at incredibly low prices. Send a s.a.e. for full lists. J.T.WILSON, 9 Cotswold Terrace, Chipping Norton, Oxon.

BBC MICRO. Send S.A.E. for details of our range of software (many arcade games). Beebonics, 2 Heathcote, Stoke-on-Tern, Market Drayton, Shropshire.

ZX81 AND VIC20. Software, Hardware and Sundries. Send 2x15p stamps for lists, or £1 (refundable) for catalogue. Details of new LOCAL USERS CLUB. D/J Enterprises, 69 Adamsrill Road, London SE26.

ACORN ATOM 12K RAM, 12K ROM includes F.Point and full graphics. Separate PSU 5V3A, no heat problem! £200.

BBC MICRO

Make the most of your BBC Microcomputer by joining the major users' club, the Independent Acorn (BBC/Atom) Users' Group. We publish a monthly club magazine, INTERFACE, with many hints, tips, articles and programs for the BBC Microcomputer in each issue. If you're serious about using your BBC machine, join the experts. Sample issue of INTERFACE, £1.

**BBC Users' Group,
Department CT,
44-46 Earls Court Road,
London W8 6EJ.**

NASCOM GEMINI MULTIBOARD GRAPHICS SOFTWARE FROM CCSOFT

NAS-GRAPHIPAC adds graphics commands to your NASCOM ROM BASIC, fast, powerful and easy to use. Requires graphics ROM. Supplied on tape in N2 format. **£20**

GEM-GRAPHIPAC. For CP/M systems fitted with the Gemini G812 video card. This runs with Microsoft's Mbasic adding over twenty graphics commands. Supplied on disc **£35**

GEMINI ECONOMY BASIC for cassette or disc systems running under RP/M or CP/M fitted with the Gemini G812 IVC. This low cost CP/M compatible floating point BASIC also includes commands found in GEM-GRAPHIPAC. **£25** on cassette in Gemini format or **£28** on disc.

Stocked by your local Microvalue dealer.

DATA SHEETS AVAILABLE

| | | |
|-------------|------------|--------------------|
| PENUP | PSET X,Y | PLOT A,D |
| PENDOWN | PRESET X,Y | DRAWN X,Y "string" |
| PENFLIP | PTEST X,Y | CIRCLE R,A1,A2 |
| PENERA | DRAW X,Y | FCON |
| STARTAT X,Y | DRAWTO X,Y | FCOFF |

Mail order from P&P £1 per order
CCSOFT, 83, Longfield Street, Southfields,
London SW18.

ZX81 QUALITY 16K SOFTWARE BY "MICROX". All programs recorded on high quality cassettes. Prices are per program. MICROVADERS, COLDITZ, £5.95. MICROBOX, BREAKOUT, OHELLO, GOLF, FIGHTER, TRAFALGAR, TOP FORM, £4.95. EVEREST, PICTURE GALLERY, STARTREK, ANIMALS, GUILLOTINE, £3.95. LIFE, SOLITAIRE, MAZERUN, LETTERS, LINE UP FOUR, NOUGHTS AND CROSSES, £2.95. S.A.E. for list to "MICROX", 52 The Strand, Worthing, Sussex. Tel. Worthing 49584.

NEW MODEL POCKET COMPUTER

PC-1500 With free book "Pocket Computing Made Easy" £169.95.
CE — 150 Colour Printer £149.95. CE — 151 4K RAM £49.95. PC — 1211 With free book of programs £79.95. CE — 122 Printer £69.95. Cassio FX702P with free book of 35 programs £99.95. FP — 10 Printer £44.95. FA2 Interface £19.95 prices include VAT and UK delivery.
Full support from the Pocket Computer Specialists — Hardware, Software, Books.
Send for the Ekan File.
"Can your nerves take it?"
**ELKAN ELECTRONICS,
FREEPOST (no stamp required) Prestwich,
Manchester M25 6LZ**

ZX81 + 16K BASIC TUTOR

***IDEAL FOR CHILDREN*
NO MANUAL NEEDED
*COMPLETE ON TAPE***

Send £5 chq or P.O. to:-

**"EON Computing"
17 Sidney Rd.,
Wood Green,
London N22 4LT**

Mail Order Only.

ATOM OWNERS! THIS IS WHAT YOU'VE BEEN WAITING FOR!

A single card EPROM PROGRAMMER for 2k and 4k EPROMS (2716's, 2532's, etc) Plugs directly into the ATOM extension socket. PROGRAMS, DUMPS and COMPARES any part of memory. ON BOARD + 25V INVERTOR (Software Controlled) plus powerful M/C software in ROM.
Why keep all your software on slow cassettes? Join the EPROM SET today.

| | |
|------------------------------------|--------|
| Board completely built and tested | £64.95 |
| Chipset (IC's 1-5) for within ATOM | £15.50 |
| PL6 indirect plug for ATOM | £3.45 |
| 2716 EPROMS | £2.90 |
| 2532 EPROMS | £5.90 |

All prices are inclusive, but add 50p p&p for orders under £15.

S.A.E. for more details to:
**CUSTOM MICRO
RUSSELL HOUSE
RUSSELL PLACE
EDINBURGH EH5 3HA**

NORWEGIAN ZX-USER GROUP looking for used ZX81s. Contact Jan Otto Reberg, Bjerkelundvn. 15, 1400 Ski, Norway.

ATOM UTILIROM1

Extend your ATOM with these useful routines. Simply plug rom into the spare socket in your atom. No other mods needed.

COMPACTOR Removes all REMS/spaces. Abbreviates INPUT, PRINT, GOTO, GOSUB etc. Up to 20% more memory saved.

RENUMBER Basic lines open or close
KEYBOARD SCAN Ideal for games. Checks for keypress without wait.

MACHINE CODE MONITOR Examine or change memory locations run machine code programs etc (without basic).

DISASSEMBLER A complete disassembler converts object code into source code as per ATOM format. All this At A Price You Can Afford Only £7.95 incl.

EPROM PROGRAMMER for 2516/2716/2532/2732. Program any single, multiple location or complete EPROM in under 2 mins. Uses 6 cheap TTL ICs for complete reliability. Software supplied for 6502, 6800, Z80 plus flowcharts circuit, full instructions and fibreglass P.C.B. Only £13.75. Software available for 6800, 6502, Z80 send 50p for catalogue.
J.MORRISON (MICROS), 2, GLENSDALE STREET, LEEDS LS9 9JJ. TEL(0532) 480 987

ZX81 (16K) STAR TREK. Features include 8x8x8 galaxy, phasers, photon torpedoes, scanners, shields, star bases, etc, etc. On cassette with full instructions for only £3.95. Or send large SSAE for free catalogue. Aquarius Software, 53 Towncourt Crescent, Petts Wood, Kent BR5 1PH.

**BBC MICRO GAMES
INVADERS + BREAKOUT + DODGEMS**
Colour Graphics (Modes 5&7) + Sound.
Three programs on one cassette.
All work on Model A machine £4 (incl) From:
**B.Cridland, 8 Bowness Ave.,
Fleetwood, Lancs.**

nascom +

ATOM EPROM PROGRAMMER

2516 2716 TMS2532 2732 (+ 5v)

Fully built c/w mains P.S.U., quality Z.I.F. Soc., Doc., all cables & connectors and software on cassette inc. V.A.T. and p&p.

PRICE Bare P.C.B., Doc., and Software £12, fully built £40. State machine.

**TO 'M. M. Microcomputers'
24 MEADOW WAY, MELTON
MOWBRAY, LEICS. LE13 1DT.
FOR DETAILS WRITE OR
PHONE 0664 67854**

PET OWNERS

**NOW YOU CAN HAVE A PRINTER
FOR UNDER £80!**

Use the Sinclair ZX printer with the CiGOL plug in interface module C8101.

No soldering or wiring required — just plug in and print 25 x 40 screen display either by direct command or from an instruction contained within your BASIC (or m/c code) program.

Send £30 for C8101 — printer not supplied — stating PET series No. to:

**CiGOL CONTROLS Ltd.,
58 Station Rd.,
Thurnby,
LEICESTER. Tel. (0533) 412940.**

ACORN ATOM

QUALITY MACHINE CODE SOFTWARE

SPACE ADVENTURE (12K gr. 4 m/c)£6
Real time adventure in an alien space world.
SPACE INVADERS (12K gr. 4 m/c)£6
Full feature version of the arcade game.
REVERSI (7K gr. 0 m/c)£6
8 levels of play, graphics board, problem setting, etc.
3D LABYRINTH (9K gr. 3 m/c)£6
Find your way out of a 3D maze displayed in 3D.
AIR STRIKE (9K gr. 3 m/c)£6
Attack the enemy, but watch out for flak and enemy planes.
CHASE (9K gr. 4 m/c)£4
Fast thinking required to beat the robots.
ROAD RACE (4K gr. 0 m/c)£3
Try staying on the track for as long as possible, but beware of other cars overtaking.
FIZZLE BRICKS (4K gr. 1 m/c)£3
Moving wall breakout with a difference.
ELIZA (7K gr. 0 m/c)£3
Converse with your sympathetic computer. With excess of 100 replies.

All prices shown are inclusive, no extras. SAE for catalogue free with each order. All games with sound and supplied on quality C15 cassettes.

BBC Microcomputer

Space Invaders (mode 5 m/c)£6
Full feature version of the popular arcade game.
Middle Kingdom (mode 7 BASIC & m/c)£6
Adventure game with over 300 'rooms'. Fight the many monsters and retrieve the treasure.
Reversi (mode 5 m/c)£6
Graphics board, 6 levels of play etc

SAE for full details. All software shown above will run on Model A or Model B computers. (Mail order only).

**Pro Software,
121 Tyn-y-Twr, Baglan,
Port Talbot, West Glam SA12 8YE**

ZX81 EPROM/RAM expansions, 2K-8K EPROM £17.50p. EPROM programming £2.75p/K. Eprom Services, 3 Wedgewood Drive, Leeds LS8 1EF. SAE or 667183.

BOX YOUR DISK DRIVES

Attractive aluminium do-it-yourself boxes for drives. Pre-painted cover and front panel. Will house two 5 1/4 inch drives plus power supply and controller card.

Price £20 + package + carriage £5 + VAT.

P.G. Rothery & Son Ltd.,
100-104 Upper Richmond Rd.,
London SW15.
Tel: 01-785 9721.

SCHEMATIX ZX81 ADD-ONS

Circuit diagrams & assembly instructions for sale. Easily built by the competent electronics hobbyist. All circuits tried and tested. Send s.a.e. for details

REPEAT KEY FACILITY £1.00
PROGRAMMABLE CHARACTER GENERATOR £2.00
RAM EPROM BOARD £2.50
16K/32K RAM BOARD £2.50
+12, -5, -5V RAM POWER SUPPLY £0.50
Prices are all inclusive. Send cheque or postal order to:
SCHEMATIX, 39 Almond Avenue, Dean Park Estate, Renfrew PA4 0UT.

UK101 SCRAMBLE

A new full speed machine code implementation of the famous game for the 32x48 (8K, any monitor) UK101. Bomb the ground installations while navigating the tricky brain and dodging or shooting the enemy fighters. Look out also for the rockets shot at you and the ack-ack fire. Destroy fuel dumps to reserve fuel for the treacherous castle section.

Send £5 or an SAE for full details to:

Adventure 10, 43 Barclaycroft Road, Welwyn Garden City, Herts AL8 6JX.

MZ80K ARCADE PACK £4 containing Bounce, with high score retainable on tape, Lunar Lander, Reaction Timer. Turley, 13 Hampshire Drive, Wrexham, Clwyd LL11 2UT.

ATOM GAMES. The best Adventures: Atom Adventure £6.75, Pirate Island £6.75, Write Your Own £5.75. The best PacMan: Atom-Man £6.75. All need 12K, all in machine code. SAE for details. HOPESoft, Hope Cottage, Winterbourne, Newbury, Bucks.

ZX80, 8K ROM, 4K ROM, 16K RAM pack, (ZX81/ZX80 books worth £25) Invaders tape, £100, o.n.o. Tel: 01-504 7050 evenings.

APPLE II 48K disk drive, 16K RAM card, colour card £700. 061-665-1524.

TINY PASCAL for PET/Apple. £31 (graphics) £23 (non-graphics) cassette or disk. Adamsoft, 18 Norwich Avenue, Rochdale OL11 5JZ.

SPACE FIGHTER
A space dogfight simulator

8K UK101 ON CASSETTE

£3.95

WITH AY38910/12 SOUND
ARCADIA SOFTWARE,
4 Chestnut Ave, Swansea SA3 5NL

PARAPHYSICS JOURNAL (Russian translations); Psychotronic Generators. Kirlianography, gravity lasers, telekinesis. Details: SAE 4 x 9". Paralab Downton, Wilts.

APPLE II — 48K (disc)

School Administration Program Including Form 7. Mathematics and general programs for Apple II and for the BBC microcomputer. S.A.E. for list.

G. W. Gallagher, 14 Selkirk Close, Worthing, West Sussex. BN13 1PR.

HEARING IS BELIEVING

TELESOUND 82 combines with most home computers allowing full spectrum sound effects to be heard through an unmodified television set. Incredible but true, the Telesound 82 unit fits SINCLAIR'S ZX81 to get realistic sound effects even with animated graphic games. Connections are made easy by leads fitted with alligator clips. The Telesound 82 ready built, complete with program for the above computers, costs only £9.95 incl.

===== COMPUSOUND =====
32 Langley Close, Redditch, Worcs B98 0ET

NEW BOOK

'STRETCHING YOUR ZX81 OR ZX80'

More information on how to improve your programming and get the most from your machine. Only £6.95 from:

DEPT CTC,
Computer Publications,
Unit 3,
33 Woodthorpe Rd,
Ashford, Middx.

SALE

Paper Tape Punches and Readers, Cassette Drives, Printers, Voltage Stabilisers, VDU's, PDP8M, PDP8E, Memory and Modules.

Send S.A.E. for list or call and see.

GILINSKY
15 THORNHILL PARK,
SUNDERLAND SR2 7LA
Tel: 0783 44770

CENTURION BURGLAR ALARM EQUIPMENT Send SAE for free list or a cheque/PO for £5.95 for our special offer of a full sized Decoy Bell Cover. To Centurion Dept C.T. 265 Wakefield Rd., Huddersfield, W. Yorkshire. Access & Barclaycard Telephone orders on 0484-35527.

ZX81 - VAT Lists via Printer Input and Output Invoices. Checks balance after each entry. Produces V.A.T. account at end of period. SAE for details, or £9.50 for tape and instructions. S.W.P. The Laurels, Holsworthy, Devon EX22 6HX.

OSI/UK User Group

Support for

UK101 Superboard

and all OSI-based systems

professionally produced
A5-format bi-monthly Newsletter
development and documentation
and much more!

£10.00

for six-issue membership/subscription

contact: George Chkiantz
12 Bennerley Road, London SW11

NEED EXTRA CASH for peripherals new micro etc. Just send stamp for existing details on 600 ways to extra cash. From M.A. Harrison, 15 Park Drive, Maldon, Essex.

EPROM/MICRO SERVICE. All types. Erasing — 45p, copying — £2. From listings £4/1K. Assembly, test and repair computer kits and peripherals. Horndean (0705) 596243.

SPECIAL OFFER. Eprom programmer for UK101. Ready built, includes software. £27. Melmark Microsystems (092 084) 300.

NASCOM 2, 32K RAM NAS-GRAPHICS ROM, 8K BASIC, 3 amp PSU. Complete with manual, portable TV and cassette recorder — £350 ono. Tel 06286 5505.

BERKHAMSTED'S

New Computer Store
for:

**GENIE 1 & 2
NASCOM
Vic-20**

and others...

Software, Components,
Disks
Friendly HELP and ADVICE

**Chrisalid, 13, High Street,
BERKHAMSTED, Herts.
(Tel: 74569).**

UK101 SOFTWARE ON TAPE

from the guy who wrote "Le Passe-Temps"

GALACTIC HITCHHIKER (8K). An adventure, all in machine code. A beauty! (£7.00)

SUPERTREK (8K). Sail boldly through the universe zapping moving Klingons in real time. Superb graphics. (£7.00)

STARTREK (8K). The old favourite, beautifully presented. (£6.00)

LUNAR LANDER. A real challenge. You won't get down in less than 3 hours. (£3.00)

HANGMAN. Excellent graphics. P.E. said so! (£3.00)

BASIC TUTOR (8x4K). The only way to learn — at the keyboard. (£12.00)

LE PASSE-TEMPS. You NEED this, if you haven't already got it. (£3.00).

MAD MONK (8K). It's ready at last! A machine code adventure with some truly remarkable graphics, this programme is in a class by itself. (£9.50)

These ORIGINAL PROGRAMS are compatible all 2K Monitors and are available for 16x48 and 32x48 displays (including enhanced Superboards).

HARDWARE

These kits are complete in every way: — Fully socketted high quality PCB, all components, switches etc. plus preformed cable assembly for easy interconnection to J1, or our...

MOTHERBOARD SYSTEM. Now you can add on all those extras easily. Provides eight, yes EIGHT, fully buffered J1 type sockets (£19.50)

8K STATIC RAM BOARD. (£39.50)

HI-SPEED CASSETTE INTERFACE. At last, a system that works, COMPLETELY RELIABLE 4000 baud (8000 with reasonable cassette) plus software for named file handling. A delight to use. (£19.50). For software in EPROM, add £6.00.

VIDEO ENHANCEMENT. Switch selectable 16x48 or 32x48 displays without butchering your computer. (£19.50) Monitor EPROMS re-blow to suit for just £2.50

8K EPROM BOARD (£19.50). A 2K Extended Monitor is available in EPROM for £12.00 plus, coming soon, TOOLKIT in EPROM and BASIC V.

MONITOR BOARD. Plug into Monitor socket to provide switch selection of up to 4 EPROMS. (£9.50) AVAILABLE SHORTLY: EPROM Programmer. PIA/Sound Board, Analogue and something rather nice on the graphics side...

All inclusive prices — absolutely no hidden extras.

Please write or phone for further details

A. KNIGHT (Dept. CT), 28 Simonside Walk, Ormesby, Cleveland, Tel. (0642) 321266.

ZX81 SINCLAIR 16k Ram. £37. Also software and books. Owner upgrading system. Phone Wakefield 379823.

"KIM 1 SINGLE BOARD MICRO COMPUTER WANTED. Non runner considered. Telephone 01-995 6470"

ASCII KEYBOARDS

- Parallel 7 bit TTL output
- 5V Positive Strobe
- Only needs +5V supply
- Full ASCII Set
- 62 Keys inc. ESC, CAPS, REP, DEL, TAB, BSP, CTL etc.
- Complete with Circuit Diagram
- New — Unused — Guaranteed. Limited Supply
- Cased (685 x 232 x 78 mm) £34.50
- Uncased (333 x 175 x 40 mm) £32.20

CWO to **NAMEWORTH LIMITED**
31 Barnfield, Hemel Hempstead
Herts HP3 9QJ
(0442-66878/48460)

16KZX81 4 months old unwanted gift books and tapes. Offers, please Bryan, 021 356 3589. 4 Suffield Grove Erdington Bham 23.

VIDEO GENIE I plus Transtec 1200 monitor both less than two months old £300. 01 6797 1094 After 4pm.

TEST SCORE ... LATEST SCORE ... LAT
... MZ 80K ... ZX 81 ... MZ 80K ... ZX 81
... AUSSIEBUSTER ... AUSSIEBUSTER ... AUSSIEBUSTER

POOLS FORECASTING PROGRAMME

Especially designed for Australian results
 Star Value — Both programmes with
 printer options

ZX81 — £9.00 MZ 80K — £16.00

POOLSOFT

17 Blatchington Rd, Seaford, E. Sussex. BN25 2AB
 Tel. (0323) 890604



C24 Green Filter Sheet

Enhance VDU contrast ratio
 (typ. from 6:1 to 9:1 for b/w TV screen)

Reduce glare
 Improve visual acuity
 Reduce eye fatigue
 Suitable for white & green phosphors

10" x 12" (up to 14" screen) £ 3:00
 18" x 23" (up to 26" screen) £ 5:00 p&p
vat
inc.

trim to size, fixers supplied

Mesotec
 204 Harrogate Road
 Leeds LS7 4QD

**THE PERSONAL
 COMPUTER BOOK**

by Robin Bradbeer. New ed. just published.

Buying your own micro? Then you need Robin Bradbeer's Personal Computer Book. It includes an illustrated up-to-date survey of 60 micros available in the UK. Contains information on what you can do with micros, details of your nearest computer club and a survey of books and magazines. **Only £5.95.**

Available from W.H. Smith and leading booksellers, or direct from the publishers by sending £6.95 (including p&p) to Virginia Ayers, Dept. CT, Gower Publishing Co Ltd, Gower House, Croft Road, Aldershot, Hants., GU11 3HR.

**Announcing the
 UK 101 DONKEY**

The amazing new programme writer that takes the slog out of your graphics listings. Draw your display/design, etc. quickly and easily in plotting mode. Then sit back & let DONKEY write & save the programme, commencing at any number, any increment.

- Super plotter with full editing facility & protection against accidental rubout.
- Commands include: — store, restore, edit, write/save, rubout, clear screen, etc.
- Runs in 4K (MON 02) only

Cassette and user manual £15.95 inc p&p.

Also available — 'How To' cassettes at £5.95 ea
 Graphics 1 covers: — orbiting planets, homing missiles, on-screen explosions, and more. Graphics 2 covers: — large figures/letters, simulation/animation, digital clock, and more. Both above are in two complete 4k sections.

Super pack — all 3 cassettes only £24.95 inc.

**OPUS 2 (software) 525/531 London Road
 Westcliff on Sea, Essex. (0702) 42339.**

**DON'T MISS
 THE NEXT
 ISSUE
 OF
 COMPUTING
 TODAY**

**RING JENNY
 ON 01-437 1002
 FOR ALL YOUR
 ADVERTISING
 REQUIREMENTS
 DEADLINE
 MONDAY 10TH
 MAY.**

ZX81 (16K) EDUCATIONAL SOFTWARE
 G.C.E. "O" Level French: 3 (16K) programs Grammar plus 3 (16K) programs vocabulary. G.C.E. "O" Level Maths: 3 (16K) programs ranging over whole syllabus. Junior Maths 1: Long Mult, Long Div, HCF, LCM, fractions 1 (+ & -), fractions 2 (X & +). Junior Maths 2: areas, perimeters, simple equations, percentages, sets, Venn diagrams. Junior English 1: Meanings 1, Meanings 2 (harder), parts of speech, proverbs, similes, anagrams. Junior English 2: Idioms, Opposites 1, Opposite 2 (harder), group terms, odd word out, spellings. £4.50 per cassette or send sae for catalogue to: — ROSE CASSETTES, 148 Widney Lane, Solihull, West Midlands B91 3LH.

TRS-80 LV2 16K, graphic TV adventure "Palace of Omphale" by Betty Beaumont. Cassette, documentation, £20:- Eonsoft, 126 Grange Road, Guildford.

**ZX80
 & ZX81**

Two books by Robin Norman for anyone learning BASIC with a Sinclair ZX Computer

Learning BASIC with your Sinclair ZX80

To enable you to use the ZX80 (in its original form or modified with 8K ROM) to the full plus 14 specially written programs.

0408011017 160 pages **£4.50**

ZX81 Basic Book

Covers the 1K version, the expanded 16K version and the use of the Sinclair ZX Printer. 14 original programs and a glossary of technical terms round off a most useful book.

0 408 01178 5 176 pages **£4.95**

ORDER NOW from your local bookseller
 In case of difficulty from Patricia Davies

Newnes Technical Books
 Borough Green, Sevenoaks, Kent TN15 8PH

70 ZX81 PROGRAMS

Yes 70 !!! Listings including dozens of Games, Utility, Home Finance, Calendar, Invaders, Maths, Machine Code Loader, Phone Timer, Telephone Index, Chequebook, Large Word Generator, and Hints 'n' Tips all for £4.95

ZX81 HOUSEHOLD PROGRAMS

Put your 16K ZX81 to real use. Listings for Diary, Year Planner, Bank Account, Financial/Housekeeping Budget, Telephone/Address/Birthday File, all for £5.95
 Barclaycard/Visa Accepted.

**Sussex Software, Wallsend House,
 Pevensey Bay, E. Sussex.**

TANGERINE CHESS. 7K M/C program, many levels of play; Castling, En passant; computer plays black or white. £15 for cassette to R. Laws, 8 Fulthorpe Avenue, Darlington, Co. Durham.

VIC-20 GRAPHIC games (cassettes). Zompires, Rat-trap, Hangman, Mastermind, Amaze, Simon, Othello. All 3½K, great sounds. £2.50 each, three or more 30% discount, all seven £10.00. Includes first class return p&p and listings. M. O'Neill, 5 Castlefields Road, Cheltenham, Glos.

VIC-20 SUPER lander games cartridge plus VIC programming book. £12.50 including postage. Ring Maidstone 812385

ATOM TOOLKIT £9.95

A new 2K utility ROM that simply plugs into your Atom, instantly adding 13 powerful commands including Data, Read and Restore fast line renumber (including Goto's), auto line numbering, find any string, range delete, keyboard scanning, audio tape load indication, program appending, auto load and run, variable listing, variable clear. It does not affect the Atom's normal facilities and uses no textspace. A complete manual with examples is included. Send SAE for more details. Send cheque/PO to **M.D. BATES, DEVER BARN, MICHELDEVER, WINCHESTER, HANTS. SO21 3DB.**

ACHORD ZX81:16K

GUITAR CHORD INDEX

Fast, clear display of 333 chords with fingering.

Cassette & instructions: £2.50

**CICSOF (CT), 23 Connaught Crescent,
 Brookwood, Woking, Surrey. 048 67 4755.**

SHARP MZ-80K. Enhanced BASIC with trace, renumber, delete, append, auto-number etc. Cassette only £9.50. Tape copier £4.50. Monitor ROM listings £3.99. Space invaders £3.99. HTE (Electronics), 50 Milnefield Avenue, Elgin IV30 3EL.

**CLASSIFIED ADVERTISING PAYS,
 A MESSAGE LIKE THIS WILL
 ONLY COST YOU £4.50 FOR
 100,000 READERS.**

**ZX81/ZX80 (8K ROM) PLUS TWELVE
 FUNCTIONS!**

(INSTANTLY available on POWER-UP)
 EPROM CARD + Pre-Programmed 2716 EPROM adds VERSATILITY to your ZX-Computer. Space to Spare for development of your own m/c Routines. Fits between Computer and RAM.

TOOLKIT — FUNCTIONS:

- REAP, DATA, RESTORE. Works with string and numeric variables including decimals.
- RENUMBER (GOTO & GOSUBs correctly Renumbered.)
- FILL screen with any Character INSTANTLY.
- SIZE of you Program (Bytes).
- FREE Memory in Bytes.
- BLOCK-DELETE any section of your Program.
- FAST-DELETE from any point to end.
- D-HEX Converts Decimal to Hexadecimal.
- HEX-D Hexadecimal to Decimal.
- M/LOAD Quick M/C Loading Routine.
- LIFE M/C version of Cell Generation.
- + more to come! Price £17.95 (inc p&p)

**ORME ELECTRONICS 2, Barripper Road,
 CAMBORNE, Cornwall.**

VIDEO GENIE 16K. Hardly used. Still in original box. £270. Phone Bollington (0625) 74034 anytime.

FOR SALE Microtan II, Tanbug V2.3 (£10), Tanex BASIC (£25), XBug (£10). Ring Frank (eves) 567-1092.

TANGERINE SALE — While stocks last TANEX (assembled) £44, expanded assembled £89, power supply £12, L/Case £7, graphics £5, 1KRAM (2x2114) £1, Cases £25 TANTELE £119 plus more. All new, prices include VAT P&P. Access welcome. KSL 85 Nottingham Road, Nuthall, Nottingham 0602 272465.

T199/4A(A):- SOFTWARE, Advice, Debugs, Lists, assistance of every sort! Send SAE: Stephen Shaw, 10, Alstone Road, STOCKPORT, Cheshire, SK4 5AH.

BBC SPACE Invaders runs in 16K. £5.00 from K. McKeever, 67 Danes Road, Bicester OXON.

16K ZX81 USED once only, C/W J.M.J. interfaces user port, four tapes, PSU. £95 only. Driffield 70301.

ZX81 (16K) listings 'Demons Cavern' adventure £3. 'Trap' space game £2. Both on tape £5. ZX81 (64K) with games £130 O.N.O. Softspot 26 Hall Drive, Sutton-in-Craven, Keighley Yorks.

ACORN ATOM. AHC1: Games for Atom 8+2. AHC2: Dropout, Updown, Dodge. AHC3: Princess, Dodeca dragon, Maze. AHC4: Maths and Statistics. £3.50 each, £12 all four. SAE for details. At Home Computing 99 Morely Road, Derby.

B.B.C. MICRO

Class cassette software. Fruit machine superb sound effects and colour graphics, features nudges, holds, gamble etc. £3.95. Quality at the right price. for A or B models. Cheque or P.O. to: — M. Tinning, 10 Bagford Drive, Chester-Le-Street, Co Durham.

If you find an ad unacceptable, don't turn the page: turn to us.

Every week, millions of advertisements appear in the press, on posters or in the cinema.

Most of them comply with the rules contained in the British Code of Advertising Practice and are legal, decent, honest and truthful.

But if you find one that, in your opinion, is wrong in some way, please write to us at the address below.

We'd like you to help us keep advertising up to standard.

The Advertising Standards Authority.



A.S.A. Ltd., Brook House, Torrington Place, London WC1E 7HN.

PLEASE MENTION COMPUTING TODAY WHEN REPLYING TO ADVERTISERS

AD INDEX

| | |
|---------------------------|-------------|
| ACORN COMPUTERS | 75 & 91 |
| A & F SOFTWARE | 15 |
| ANDREW DEVELOPMENT | 52 |
| ARTIC COMPUTING | 93 |
| BUG BYTE | 74 |
| BUSINESS & MICRO LEISURE | 66 |
| CAMBRIDGE COMPUTER CENTRE | 37 |
| CAMBRIDGE LEARNING | 25 |
| CASTLE ELECTRONICS | 11 |
| CATRONICS | 25 |
| CHROMASONICS | 36 |
| CLEVER COMPUTER CONTROLS | 71 |
| COMP SHOP | 100 |
| COMPUTER CONCEPTS | 78 |
| CONTROL TECHNOLOGY | 82 |
| CROWN BUSINESS CENTRE | 50 & 51 |
| CROYDON COMPUTER CENTRE | 25 |
| CSL MICRODATA | 50 |
| DDP RESEARCH & MARKETING | 71 |
| DIGICO LTD | 19 |
| ELECTRONEQUIP | 69 |
| THE ESSENTIAL SOFTWARE | 29 |
| GENERAL NORTHERN MICRO | 69 |
| HAPPY MEMORIES | 93 |
| A. J. HARDING | 64 & 65 |
| HENRYS RADIO | 51 & 76 |
| IKON COMPUTERS | 86 |
| INTERFACE | 4 |
| I.O. SYSTEMS | 93 |
| KAYDE | 6 |
| LANDER MICROSYSTEMS | 51 |
| LOWE ELECTRONICS | 32 & 107 |
| M.D.R. | 86 |
| MELBOURNE HOUSE AD | 37 |
| MEMOTECH | 60 |
| MICHAEL ORWIN | 82 |
| MICROCOMPUTER PRODUCTS | 7 |
| MICROSTYLE | 2 |
| MICROTANIC SOFTWARE | 26 |
| MICROVALUE | 30 & 31 |
| MIDWICH COMPUTERS | 76 |
| MONOLITH ELECTRONICS | 52 |
| NEWBURN ELECTRONICS | 91 |
| OSBOURNE COMPUTERS | 54 & 55 |
| PROGRAM POWER | 85 & 87 |
| QUICKSILVA | 14 |
| REDDITCH ELECTRONICS | 62 |
| ROSS SOFTWARE | 52 |
| SILICA SHOP | 38 |
| I SINCLAIR | 24 |
| SINCLAIR RESEARCH | 46, 47 & 61 |
| SOUTHERN SOFTWARE | 24 |
| SRS MICRO SYSTEMS | 15 |
| STIRLING MICROSYSTEMS | 24 |
| STRIPELAND LTD | 96 |
| SUPERIOR SYSTEMS | 44 |
| SUPERSOFT | 50 |
| SWANLEY ELECTRONICS | 86 |
| TEXAS INSTRUMENTS | 4 & 5 |
| TIMEDATA | 66 |
| U-MICROCOMPUTERS | 62 & 75 |
| VIC | 108 |
| WARD ELECTRONICS | 93 |
| JOHN WILEY & SONS | 56 |

COMPUTING TODAY — CLASSIFIED ADVERTISEMENT — ORDER FORM

| | | |
|--|--|--|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Advertise nationally in these columns to over 100,000 readers for only 30p per word (minimum charge 15 words). Simply print your message in the coupon and send with your cheque or postal order made payable to Argus Specialist Publications Ltd to:

JENNY NARAINÉ COMPUTING TODAY
145 Charing Cross Rd, London WC2H 0EE.
Tel 01-437 1002

Name

Address

Tel.No.(Day)

Please place my advert in Computing Today

NOW IN STOCK

THE NEW & EXCITING TRS80 MODEL III



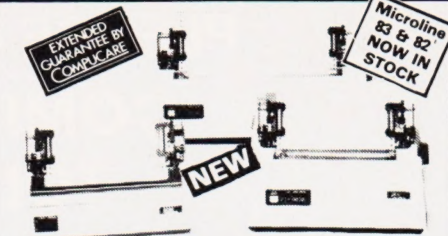
EXTENDED GUARANTEE BY COMPU CARE

48K £599 - VAT

The Radio Shack TRS 80™ Model III is a ROM based computer system consisting of:

- A 12 inch screen to display results and other information
- A 65 key console keyboard for inputting programs and data to the Computer
- A Z 80 Microprocessor, the "brains" of the system
- A Real Time Clock
- Read Only Memory (ROM) containing the Model III BASIC Language (fully compatible with most Model I BASIC programs)
- Random Access Memory (RAM) for storage of programs and data while the Computer is on (amount is expandable from "16K" to "48K", optional extra)
- A Cassette Interface for long-term storage of programs and data (requires a separate cassette recorder, optional extra)
- A Printer Interface for hard-copy output of programs and data (requires a separate line printer, optional extra)
- Expansion area for upgrading to a disk-based system (optional extra)
- Expansion area for an RS-232 C serial communications interface (optional extra)

All these components are contained in a single moulded case, and all are powered via one power cord.
 Disc Drives Kit with 2x40 Track Drives - **£599 + VAT**
 Disc Drives Kit with 2x80 Track Drives - **£729 + VAT**



MICROLINE 80 £289 - VAT

- 80 cps Uni-directional
- Small size: 342 (W) x 254 (D) x 108 (H) mm.
- 160 Characters, 96 ASCII and 64 graphics
- 3 Character sizes: 40, 80 or 132 chars/line
- Friction and Pin Feed
- Low noise: 65 dB
- Low weight: 6.5 kg

INTRODUCING THE NEW SHARP MZ-80B



£999 + VAT.

- 4 Mhz Z-80 CPU
- Dynamic RAM
- 2K ROM
- BASIC is provided
- High Resolution Graphics
- 9" High Focus Green Display
- Upper and Lower Case
- 80/40 Characters x 25 line display
- Electro Magnetic Cassette Deck included
- ASC11 Keyboard
- Numeric Keypad
- Sound Output
- Built-in Clock and Music.

Available Soon-Discs, Printers and other Accessories.

INTRODUCING THE NEW GENIE

Ideal for small businesses, schools, colleges, homes, etc. Suitable for the experienced, inexperienced, hobbyist, teacher, etc.



GENIE I

STILL ONLY £279 + VAT

NOW INCLUDED: Sound, Upper and lower case, Extended BASIC and Machine Code enabling the Writing and Execution of Machine Codes Programming direct from Keyboard.

- 16K RAM, 12K Microsoft BASIC
- Extensive Software Range
- Self-Contained PSU UHF Modulator Cassette. External Cassette Interface. Simply plugs into TV or Monitor.
- Complete and Ready to Go. Display is 6 lines by 32 or 64 Characters Switchable. 3 Manuals included, Users Guide, Beginners Programming and BASIC Reference Manual.
- BASIC Program Tape Supplied. Pixel Graphics.



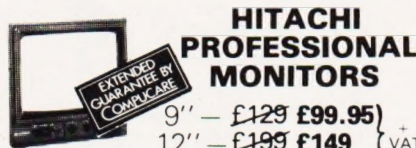
GENIE II

£299 - VAT

The **NEW GENIE II** an ideal Business Machine. 13K Microsoft BASIC in ROM. 71 Keyboard. Numeric Keypad. Upper & Lower Case. Standard Flashing Cursor. Cassette Interface 16K RAM Expanded externally to 48K.

GENIE I & II EXPANSION UNIT WITH 32K RAM £199 + VAT

PARALLEL PRINTER INTERFACE CARD £35.00 + VAT



HITACHI PROFESSIONAL MONITORS

9" - **£129 £99.95**
 12" - **£199 £149** } **VAT**

- **Reliability** Solid state circuitry using an IC and silicon transistors ensures high reliability.
- **500 lines horizontal resolution** Horizontal resolution in excess of 500 lines is achieved in picture center.
- **Stable picture** Even played back pictures of VTR can be displayed without jittering.
- **Looping video input** Video input can be looped through with built-in termination switch.
- **External sync operation** (available as option for U and C types)
- **Compact construction** Two monitors are mountable side by side in a standard 19-inch rack.



ACORN ATOM

UNIQUE IN CONCEPT - THE HOME COMPUTER THAT GROWS AS YOU DO

Fully Assembled **£157.50 + VAT** inc. PSU

- Special features include
- Full Sized Keyboard
- Assembler and Basic
- Top Quality Moulded Case
- Optional High Resolution Colour Graphics
- 6502 Microprocessor

COMPUKIT UK101

- 6502 based system - best value for money on the market
- Powerful 8K Basic - Fastest around
- Full Qwerty Keyboard
- 1K RAM Expandable to 8K on board.
- Power supply and RF Modulator on board.
- No Extras needed - Plug-in and go
- Kansas City Tape Interface on board.
- Free Sampler Tape including powerful Disassembler and Monitor with each Kit.
- If you want to learn about Micros, but didn't know which machine to buy then this is the machine for you.

KIT ONLY £99.95 + VAT } **PLUS £4.60 Post & Packing**
Fully Assembled - £149 + VAT

WE ARE NOW STOCKING THE APPLE II AT REDUCED PRICES



AUTOSTART EURO PLUS 48K £649 - VAT

Getting Started APPLE II is faster, smaller, and more powerful than its predecessors. And it's more fun to use too because of built-in features like:

- **BASIC** - The Language that Makes Programming Fun.
- **High-Resolution Graphics** (in a 54,000-Point Array) for Finely-Detailed Displays.
- **Sound Capability** that Brings Programs to Life.
- **Hand Controls** for Games and Other Human-Input Applications.
- **Internal Memory Capacity** of 48K Bytes of RAM, 12K Bytes of ROM; for Big-System Performance in a Small Package.
- **Eight Accessory Expansion Slots** to let the System Grow With Your Needs.

You don't need to be an expert to enjoy APPLE II. It is a complete, ready-to-run computer. Just connect it to a video display and start using programs (or writing your own) the first day. You'll find that its tutorial manuals help you make it your own personal problem solver.

THE EPSON MX SERIES



MX80T £339 + VAT
MX80F/T £389 + VAT

- 80/132 Column
- Centronics Parallel
- Bi-directional
- Upper & lower case
- True Descenders
- 9x9 Dot Matrix
- Condensed and Enlarged Characters
- Interfaces and Ribbons available



TEAC DISK DRIVES

- TEAC FD-50A has 40 tracks giving 125K Bytes unformatted single density capacity.
- The FD-50A can be used in double density recording mode.
- The FD-50A is Shugart SA4000 interface compatible.
- Directly compatible with Tandy TRS80 expansion interface.
- Also interfaces with Video Genie, SWTP, TRS80, North Star Horizon, Superbrain, Nascom, etc.
- Address selection for Daisy chaining up to 4 Disks
- Disks plus power supply housed in an attractive grey case

40 TRACK
 Single Disk Drive **£225 - VAT** Double Disk Drive **£389 + VAT**

77 TRACK
 Single Disk Drive **£299 - VAT** Double Disk Drive **£499 - VAT**



"Europe's Largest Discount Personal Computer Stores"

Delivery is added at cost. Please make cheques and postal orders payable to **COMPESHOP LTD.**, or phone your order quoting **BARCLAYCARD, ACCESS, DINERS CLUB** or **AMERICAN EXPRESS** number.

MAIL ORDER AND SHOP: **CREDIT FACILITIES ARRANGED** - send S.A.E. for application form.

14 Station Road, New Barnet, Hertfordshire, EN5 1QW (Close to New Barnet BR Station - Moorgate Line).

Telephone: 01-441 2922 (Sales) 01-449 6596 Telex: 298755 TELCOM G

OPEN (BARNET) - 10am - 7pm - Monday to Saturday

NEW WEST END SHOWROOM:

311 Edgware Road, London W2. Telephone: 01-262 0387

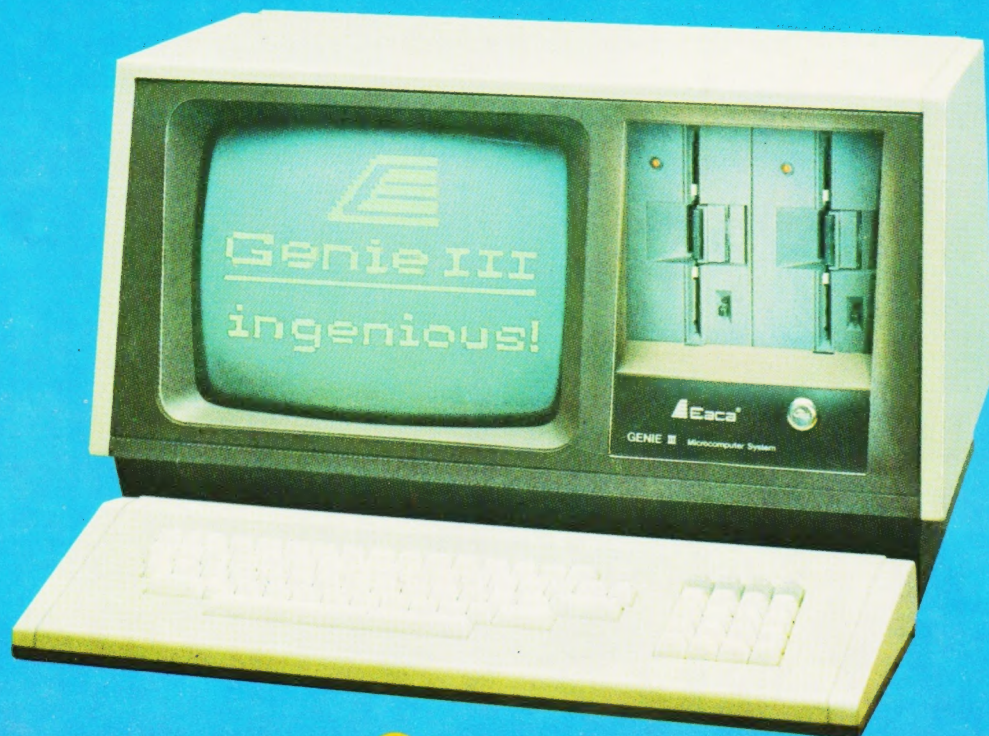
OPEN (LONDON) - 10am - 6pm - Monday to Saturday

• **IRELAND:** 19 Herbert Street, Dublin 2. Telephone Dublin 604165

TELEPHONE SALES

OPEN 24 hrs. 7 days a week
01-449 6596





Genie III...

your third and greatest wish!

The new Genie III surpasses even its predecessors by harnessing all the benefits of modern, professional microcomputing in one unit.

Versatility.

Software availability is exceptionally good – in fact the Genie III has more software available than any of its competitors. And even if you don't want to use a ready made business package, with the Genie III you can write your own! The Genie III is fully operational in either CP/M, or level II basic. It has a built-in screen, 64K RAM, and dual disk drive with 730K storage capacity, all incorporated in its compact and attractive casing.

Speed.

The new Genie III is an obedient slave in the office, quickly and quietly taking care of all your routine work, from printed invoices, mailing lists and letters to stock control.

Economy and simplicity.

It all costs less than a new office junior, yet it's simple enough to operate, and comes complete with a teaching programme to show you how.

Reliability.

Your Genie III is reliable too, manufactured to the most stringent standards with top quality

components. And even in the unlikely event that your Genie should ever temporarily fail to please you are assured of very fast, competent service because the Genie III is only available from our specially selected SUPERDEALERS. Dealers whose technical expertise and experience in the fields of installation, software availability and repair is proven.

Software.

Finally, it's compatibility with CP/M or Level II BASIC means there is more Software available for Genie III than any other comparable system!

Please send me FREE, 16 page colour brochure on the Genie Computer System. I enclose 25p postage.

Name

Address

Telephone CT 82

TOWE
electronics

Chesterfield Road,
Matlock,
Derbyshire DE4 5LE.
Telephone: 0629 4995.
Telex: 377482 Lowlec G.

SEE VIC AT THE INTERNATIONAL
COMMODORE COMPUTER SHOW,
CUNARD HOTEL, HAMMERSMITH,
3rd June 12 noon-6pm. 4th June 10am-6pm.
5th June 10am-5pm.



“Give me one good reason why I should choose a VIC 20 home computer.”

1. VIC is outstanding value for money. No other colour home computer can give so much for under £200.

2. Total standard memory 25K made up of 20K ROM and 5K RAM.

3. Fully expandable to 27½K user RAM.

4. Microsoft Basic interpreter as standard.

5. Accessible machine language via plug-in cartridges.

6. Connects direct to monitor or standard television.

7. Full size typewriter style keyboard.

8. Full colour and sound.

9. All colours easily accessible.

10. 62 predefined graphic characters direct from the keyboard.

11. Full set of upper and lower case characters.

12. 256 displayable characters direct from the keyboard.

13. High resolution graphics capability via plug-in cartridges.

14. Programmable function keys can be used with plug-in cartridges.

15. Automatic repeat on cursor function keys.

16. User-definable input/output port.

17. Machine bus port for memory expansion and ROM software.

18. Standard interfaces for hardware peripherals.

19. VIC 20 is truly expandable into a highly sophisticated computer system with a comprehensive list of accessories (see panel below).

20. Full range of software for home, education, business and entertainment on disk, cassette and cartridge.

21. Books, manuals and learning aids from Teach Yourself Basic to the VIC programmers' reference guide (a must for advanced programmers).

22. Full support for VIC owners – their own magazine 'VIC Computing' as well as a national network of VIC user groups.

23. National dealer network providing full service and support to VIC owners.

24. Expertise and experience – Commodore are world leaders in microcomputer and silicon chip technology.

25. Commodore is the leading supplier of micro computers in the UK to business, schools, industry and the home.

26. VIC 20 is the best-selling colour home computer in the UK.

How many reasons was it you wanted?

Accessories include:

- Cassette tape unit.
- Single drive 5¼" floppy disk unit (170 K bytes capacity).
- 80-column dot matrix printer.
- 3K, 8K and 16K RAM expansion cartridges.
- Programming aid packs, machine code monitor cartridge, programmers' aid cartridge, high resolution graphics cartridge.

- Plug-in conversion box for a full 32K, 40-column x 24 lines VIC including Prestel compatibility.
- RS 232C communication cartridge.
- Memory expansion board.
- IEEE/488 interface cartridge.
- Joysticks, light pens, paddles and motor controllers.

commodore
VIC 20
**The best home computer
in the world.**